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ROYAL BOTANIC GARDENS, KEW.

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XIX.—EUCOMMIA ULMOIDES.

THE TU-CHUNG OF THE CHINESE.

JOHN PARKIN.

Our knowledge respecting *Eucommia ulmoides*, Oliv. has been largely gained from information supplied by Professor Augustine Henry, when resident at Ichang in China 1882–1890, and from the examination of fruiting specimens sent home by him during this period.* It is cultivated in the hilly regions of Central and Western China, and though reported to be wild, has not yet been seen so by Europeans.

The tree is grown by the Chinese for the sake of its bark, which they value highly as a drug, so much so that it commands a fancy price. To us, however, the bark is attractive on account of its containing silky, silvery threads. These can readily be made visible by breaking across a piece of bark and gently pulling apart the two fragments, which are then seen to be held together by numbers of delicate threads. These occur also in the leaves and fruits. They have been regarded as elastic, but this must be more apparent than real, as the material composing them is more akin to gutta-percha than caoutchouc (india-rubber). These substances† as a rule occur in the living plant in the form of minute globules suspended in a watery medium, the two together forming a "milk," which is held in elongated cells or vessels. Hence have arisen the botanical terms, "latex" and "laticiferous tube" for the emulsion and receptacle respectively. *Eucommia*, however, is exceptional in having its gutta-like substance existing in the dry, solid state in the living plant; so no milky juice exudes from any part when punctured. It shares this peculiarity along with the composite *Parthenium argentatum* (the source of Guayule Rubber) (*Kew Bull.* 1907, p. 285; 1908, p. 255; 1910, p. 211), and with *Chrysothamnus nauseosus* (Rabbit bush), a Composite plant of Colorado and

* Oliver, D. Hooker's Icon. Plant., xx., 1890, t. 1950. *Kew Bulletin*, 1901, p. 89; 1904, p. 4.

† An embracing term is much needed for these plant products (caoutchouc, gutta-percha, balata) of which the significant ingredient is a hydrocarbon of the turpene $(C_{10}H_{16})_x$ series. "Elastic gum" is not suitable as only one member of the group is markedly elastic.

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the neighbouring States of North America, which is said to be capable of supplying rubber of fair quality and in large quantities should it ever be needed to supplement that of *Hevea brasiliensis*.

Taxonomic Position. Systematically this tree occupies a somewhat isolated position. It is the sole member of the genus, *Eucommia*, which the late Prof. Oliver established for its reception.

From material supplied by Prof. Henry, Oliver* described the plant in 1890 and named it *Eucommia ulmoides*. In a further paper† he refers to the identity of his *Eucommia ulmoides* with Baillon's *Euptelea Davideana*, on the authority of Baillon‡ himself, but this identification was not justified, the two plants belonging to quite different genera§. He points out that though the nearest ally of *Eucommia* would appear to be *Euptelea*, it differs quite sufficiently to warrant the creation of a new genus for its reception. He further considers that there can be now no reasonable ground for hesitation in separating this genus, *Eucommia*, along with *Cercidiphyllum*, *Euptelea*, *Trochodendron* and *Tetracentron*, from the *Magnoliaceae*, and in placing them in a distinct family. He agrees to adopt Prantl's name, *Trochodendraceae*, for this new family, which differs chiefly from the true *Magnoliaceae* in having naked flowers (no perianth) and in being without oil glands. He lays stress on two features possessed by *Eucommia*, viz., solitary ovary with bifid stigma and caoutchouc-containing cells, which serve to distinguish it from *Euptelea*. As regards the first-mentioned feature, it may be asked: Are we to infer that the flower of *Eucommia* possesses a single carpel only, or that it has really a syncarpous dicarpellary gynoecium? If the latter inference be correct, then *Eucommia* would seem to be still less related to *Euptelea*; in fact its inclusion in the *Trochodendraceae* would be hardly warranted.

It is not the intention here to discuss fully the systematic position of this interesting tree, but it may be pointed out that Solereder‖ from his investigation of the female flower considered it syncarpous and dicarpellary, and was inclined consequently to place the plant in the *Hamamelidaceae*. Van Tieghem¶ likewise did not regard it as belonging to the *Trochodendraceae*, and to emphasize its isolated position, made a new family, the *Eucommiaceae*, for its reception. Engler agrees with this view, for in the latest edition of his *Syllabus der Pflanzenfamilien* (1919) the family, *Eucommiaceae*, occurs and is put in the cohort, Rosales, next to the *Hamamelidaceae*.

* Oliver, D. l.c.

† Oliver, D. Hooker's Icon. Plant., xxiv., 1895, t. 2361.

‡ See letter from Baillon to Oliver in Herb. Kew.

§ See Hemsley in Hook. Icon. Pl. in syn. sub t. 2787.

‖ Solereder, H. Ber. Deutsch. Bot. Gesell., xvii., 1899, p. 387. In this paper the author disputes the identity of *Euptelea Davideana* Baill. with *Eucommia ulmoides*, Oliv., and considers it rather to be identical with *Euptelea pleiosperma*, Hook f. et Thoms. [This opinion was confirmed by Hemsley, l.c.—Ed.]

¶ Tieghem, van P., Journ. de Bot., xiv., 1900, p. 262; *see also* Mr. Hutchinson's paper on *Winteraceae*, p. 185 of this number.

Further investigation of the flowers of *Eucommia* and especially of the pistillate ones, would seen desirable in order if possible to gain new light on its real affinities.

Anatomical. Prof. Weiss* in 1892 worked out the development, distribution, and microscopical characters of the cells which elaborate these " elastic " threads in *Eucommia*. He also investigated to some extent the substance itself extracted from the bark.

Barthelat† and Dybowski et Fron‡ have since supplied extra details regarding the structure of these gutta-percha producing elements and their distribution in the plant.

This tree might repay further study from the anatomical side. The wood especially requires minute examination. Facts might possibly be forthcoming which would throw light on its relationship.

The Gutta-like Material. Weiss considered the substance composing the " elastic " threads of the bark to be of the nature of caoutchouc from its behaviour towards solvents. Consequently the specialised elements in the plant holding this material came to be termed caoutchouc-containing cells, and the tree itself to be spoken of as a rubber-yielding one for temperate climates.

Dybowski et Fron‡ from their economic enquiry came to the conclusion that the substance is much nearer akin to gutta-percha than caoutchouc. A French authority to whom they submitted a sample declared it to be gutta of good quality.

Sievers§ in a recent paper, apparently unaware of the French work, treats the substance as rubber and investigates its solubilities in various media.

In order to arrive at a rough idea of the amount of this material contained in the bark, Weiss ground up some of the latter and then extracted it with chloroform. He obtained a yield of 3 per cent. Oliver working independently with another sample of bark secured the same yield. Sievers by ether extraction obtained only a yield of 2 per cent. Dybowski et Fron estimated quantitatively the amount in the dried leaves and found that the percentage of gutta reached 2·25. The fruits were richer in the substance. Apparently the percentage in the bark was not ascertained by them.

In 1910 two bales of *Eucommia* bark secured in China came into the writer's possession. One bale contained 56 lbs. of bark and the other, though not weighed, presumably held half this quantity, judging from its size. During the rubber boom of that year considerable interest was taken in *Eucommia*. This, however, soon subsided and nothing of importance was published at that time regarding this tree, which was commonly

* Weiss, F. E., Trans. Linn. Soc., London, 2nd ser. Bot. III, 1892, p. 243.

† Barthelat, Journ. de Bot. xiv., 1900, p. 55.

‡ Dybowski et Fron, Comptes Rendus, cxxix., 1899, p. 558.

§ Sievers, A. F., Journ. Amer. Chem. Soc., xxxix., 1917, p. 725.

spoken of as a hardy rubber-yielding one, in spite of the French work, already referred to, published ten years previously. The writer at this period took up the investigation of the bark. A preliminary examination convinced him that the substance had not the characteristics of rubber. On the other hand though resembling gutta-percha, it was found to be tougher and less plastic on heating.

Extraction by means of solvents is not, as a rule, to be recommended for rubber, gutta and such like bodies, as their desirable physical properties are apt to suffer in the process. Mechanical separation, when possible, is to be preferred. A firm of engineers interested in the rubber industry undertook in 1911 to experiment with the bark. The smaller bale was delivered over to it and attempts were made to separate the gutta-percha from the *Eucommia* bark; but the results were not satisfactory. The substance could not be obtained free from particles of bark. With the rapid fall in the price of raw rubber from the boom figures of 1910, interest fell off in new sources of rubber and allied substances, and business firms were no longer eager to experiment with unknown barks.

After the war Dr. P. Schidrowitz, to whom I am indebted for the information below, kindly undertook the investigation of the larger bale of bark and managed with some difficulty to separate in a clean state the gutta-like substance, which is tough and almost horny in consistency, and has the dark colour of most raw rubbers, but without their elasticity It is quite free from stickiness. By mechanical extraction the bark yields about two per cent.; whereas that of ordinary gutta trees gives twice or thrice this quantity.

The composition of this material is approximately as follows :—

Moisture - - - - -	5·0 per cent.
Ash - - - - - -	2·5 „
Resin - - - - - -	70·0 „
"Gutta-percha" - - - -	22·5 „

i.e., hydrocarbon $(C_{10}H_{16})_x$

It thus has a higher percentage of resin and a lower percentage of $(C_{10}H_{16})_x$ hydrocarbon than the raw gutta-percha of commerce, obtained from sapotaceous trees.

As regards its physical properties and economic possibilities Dr Schidrowitz wrote to me in March, 1920, as follows :— "The material is not as plastic as high grade gutta-percha. It is very tough, but the gutta—after extracting the resins—is decidedly 'short' and does not compare favourably with 'hardened' (*i.e.*, extracted) gutta-percha. The electrical (insulation) properties are probably similar to certain grades of gutta, but so far as 'ageing' goes, the indications are that it does not compare favourably with good gutta. Of course, at a really low price (say 1/– to 1/6 per lb.) a use might be found for it, but I gather that anything of that kind is out of the question.

To get reliable tests as to strength, &c., I should need a good deal more of the material than I have."

Since then it has been found that mechanically extracted *Eucommia* gutta soon becomes brittle with age, which would render it well nigh useless for electrical purposes.

Medicinal Properties. *Eucommia* bark is held in high esteem as a medicine by the Chinese and is said to have invigorating and arthritic properties; but it is doubtful whether the bark really contains any principle of therapeutic value. A cursory examination of the dry bark from this point of view has resulted in the extraction of only a minute quantity (0·038 per cent.) of presumed alkaloid.

The Chinese believe in the doctrine of signatures, which asserts that a plant shows some resemblance to the organ of the body, for the disease of which it is useful; and the peculiar threads in this bark may have suggested its use as a drug to the Chinese.

The writer has still a little bark and some dried leaves at his disposal should anyone care to investigate *Eucommia* further from the medicinal aspect.

Growth and Behaviour of the Tree in the British Isles. France was the first European country to receive the living plant from China—apparently about 1890. Kew obtained in 1897 one *Eucommia* plant from M. Maurice de Vilmorin. This flowered for the first time in 1909 and proved to be a male tree. The other trees there have been propagated vegetatively from the original one. Some years ago information was supplied by Kew* respecting the hardihood, cultivation, and propagation by cuttings of *Eucommia*. Last winter Mr. W. J. Bean kindly furnished me with up-to-date details regarding the trees at Kew. He wrote as follows:—"At present we have four trees viz., the original one which never having been trained, has remained bushy and comparatively low; and three trees raised from cuttings taken from the original tree. The largest of these is now about 23 feet high, its trunk 22 inches in girth and clear of branches up to 7 or 8 feet. The other two have trunks 21 and 16 inches in girth respectively." He proceeds to say that pruning and training were found to be necessary to produce the tree-form in *Eucommia*, but thinks that if they were planted close enough they would form trees naturally.

The Royal Botanic Gardens, Edinburgh,† possess two trees. They were raised from Wilson's seed, No. 383, and were planted in their present position in 1911 in prepared ground on a lawn. They now measure‡ respectively in height 8 and 5 feet and in girth 5½ and 4 inches. They are bushy and have not yet flowered.

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* Gardeners' Chronicle, xxxiii, 1903, p. 104. Kew Bulletin, 1904. p. 4.

† From information supplied by the Regius Keeper, dated 9.xii.20.

‡ The measurements recorded in this paper were taken in each case last winter (1920-21).

There are likewise two plants in the Royal Botanic Gardens, Glasnevin,* Dublin, which were raised from Wilson's seed and have been growing there about ten years. One is 15 feet high on a single stem and the other 8 feet and bushy. Both are thriving.

There are also two trees growing in the University Botanic Gardens,† Cambridge. One was obtained from Veitch and Son in 1905 and is 16 feet in height with a girth of 10 inches. The history of the other is uncertain. It is nearly 15 feet high with a girth of 12 inches. They are both growing in ground kept free from grass and weeds and are tree-like in habit.

Reports were also received last winter from several private British gardens and I wish here to express my thanks to the writers of the same.

At Sprowston Hall, near Norwich, Sir Eustace Gurney planted some Eucommias about ten years ago. They were obtained from M. de Vilmorin and were apparently rooted cuttings. All but two have been discarded. These are now only 12 feet high and 9 inches in girth, though well-sheltered and growing in good soil, kept free from grass.

Mr. Reginald Cory has two trees growing at Duffryn, near Cardiff. One obtained from Veitch and Sons, planted 1911 and once transplanted since, is now 15½ feet high and nearly 8 inches in girth. It is growing in cultivated ground and is tree-like in habit. The second tree was obtained as a sucker from the former 5–6 years ago and has grown well, being over 13 feet in height.

Mr. Gerald Loder possesses three trees, growing at Wakehurst Place, Ardingley, Sussex, also obtained from Veitch & Sons. One planted in 1910 in poor dry soil is 11 feet high (once had its top blown off) and 9 inches in girth. The other two planted in 1914, one in deep loam and the other in clay, are respectively 9½ and 9 feet high and 3 and 4½ inches in girth. The trees were planted carefully with the idea of keeping the ground clear of grass, but owing to the war this has been largely neglected.

Several trees, raised from Wilson's seed and planted probably between 1911–13, are growing in heavy clay at Aldenham House, Elstree, Herts. Measurements of three of these have been sent by the Hon. Vicary Gibbs, who states that these would approximate to those for the other trees. Their heights and girth respectively are 12 feet and 8 inches : 10½ and 5 : 9½ and 5.

All the reports received agree in one particular, namely, that *Eucommia* is perfectly hardy. At Duffryn the trees came through unharmed the winter of 1916–17, when 26 degrees Fahrenheit of frost were registered. At Aldenham they have withstood a temperature even below zero Fahrenheit.

Respecting all the above trees flowering has only been observed in the case of the Kew trees.

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* From information supplied by the Keeper through Prof. Henry, dated 3.xii.20.

† From information supplied by the Superintendent, dated 16 & 24.xii.20.

In the spring of 1910 the writer obtained from France a specimen of *Eucommia*. It was planted in a sunny portion in cultivated ground in a Cumberland garden, situated 200 feet above sea level and 8 miles inland. It has grown very well and has the following dimensions: height 17 feet, girth 13 inches. The severe frost we experienced in the north-west of England in November, 1919, killed a fair amount of the previous summer's growth of this tree. Male flowers were observed on it for the first time in the spring of 1919. It has bloomed in a similar fashion both last spring and this, without any signs of female flowers.

In April, 1911, I obtained two plants from Messrs. Barbier et Cie., Orleans One was planted in the open on grass in a frosty situation. It did not survive the following winter. The other one was put in cultivated garden soil and has once been transplanted. It is now 9½ feet high and 4 inches in girth.

In the autumn of the same year I obtained two dozen one-year seedlings which had been raised from Wilson's seed. They were wintered in a cold greenhouse and planted in the garden the following spring, where they grew well under cultivation. The attempt, however, to establish them in the open under forestry conditions has not met with success. Seventeen of them were pitted, mainly in the spring of 1916, along with other deciduous trees on a rough grassy bank. Ten of these have died and the remaining seven, though living, are not flourishing and may ultimately succumb. The new growth does not ripen sufficiently to withstand the frosts of winter and more especially the bleak winds of early spring. It would seem that in order to establish a plantation of *Eucommia*, in this part of England at any rate, cultivated ground with shelter would be necessary.

Eucommia, though a quick grower, has not a very satisfactory tree-habit of growth. It is inclined to put its energy into subordinate sucker-like shoots, rather than into a single main leader. These shoots may attain as much as three feet in length during one season and are probably induced through the dying back of some of the last summer's growth. The tendency to a spreading, bushy, habit may be overcome to some extent by training and pruning. It remains to be seen whether *Eucommia* when closely planted would assume the tree-habit naturally and be drawn up with a straight stem.

Apparently plants raised from cuttings produce as good specimens as from seeds; though as to the ultimate height and girth reached by trees propagated in these two ways, no particulars are to hand. The plant cannot be raised from cuttings in the same easy manner as succeeds with willows, poplars, roses, etc. They require to be taken from the current year's growth in the middle of summer and subjected to gentle bottom heat. Probably layering might be found a more successful way of increasing this tree. Apparently it is one that would sucker freely and by this means shoots would be provided for layering.

The dearth of flowers calls for some comment. So far only the Kew authorities and myself have reported the production of flowers (male ones in both cases) by *Eucommia* in this country. As they are inconspicuous, they could be easily overlooked by anyone not familiar with them and not especially interested in the plant. They are produced just before the leaves in late April or early May, and the greenish-yellow appearance they give the tree might be mistaken for the bursting forth of the foliage leaves. This refers to the male (staminate) blooms only, but judging from analogy the female (pistillate) ones are likely to be even less noticeable. It is therefore quite possible that *Eucommia* may have flowered elsewhere in the British Isles, but the occurrence has escaped notice.

The tree is regarded as dioecious, and if this be correct then the offspring arising vegetatively from a single seedling will all be of one sex. This might account for the staminate nature of the British trees which have been observed to flower; but the behaviour of the Eucommias in the Arnold Arboretum suggests something more than chance in the non-production of female flowers. Professor Sargent informs me that the trees there have flowered for a number of years and are all staminate, and that he does not know of a pistillate plant in cultivation. Is the tree really dioecious? It may be monoecious and if so either climate or more likely age may influence the production of female flowers, and if so a fresh batch of seedlings may still disappoint in producing only male flowers. The plant evidently requires further study in China as regards its manner of flowering.

Economic Possibilities. The cultivation of *Eucommia* as a source of gutta-percha would appear to be a very doubtful economic undertaking, even if its gutta were found to be of commercial value. Anyone interested in trees and not minding expenditure which might never be remunerative, would by planting an acre, or even a less area, of this tree afford an instructive lesson as regards its sylvicultural possibilities. The experiment should preferably be tried in a mild part of the kingdom, such as the S.W. of England or of Ireland. There would then be little danger of the crippling effect of frost on the previous summer's growth, and at the same time conditions would be favourable for the assumption of the tree-rather than the bush-habit of growth

Given a use for the gutta-like substance and quick growth of the plant, there would still be drawbacks to be faced in its cultivation as an economic tree, viz.:—

1. The yield from the bark is low.

2. The gutta is not easily separated mechanically from the bark. This, however, might be overcome by engineering ingenuity.

3. As the gutta exists in the dry state in the living plant, it could not be extracted by tapping as in laticiferous trees. Hence a *Eucommia* tree could only give a yield of gutta once

by felling it and stripping it of its bark, (*a*) unless the substance could be extracted economically from its leaves or annual prunings, (*b*) or unless some means of paring off the bark without destroying the cambium could be devised, (*c*) or unless the tree were amenable to the coppice system. The last possibility is perhaps the most likely. In this case the peeled poles might form a subsidiary source of revenue.

4. High cost of land and wages.

In conclusion the writer would like to take this opportunity of expressing his thanks to Prof. Augustine Henry for much help in the compilation of these notes.

XX.—THE FAMILY WINTERACEAE.

J. Hutchinson.

The family *Winteraceae*, as here understood, has usually been regarded as a tribe of *Magnoliaceae*, and it stands as such in the classifications of Bentham and Hooker (Genera Plantarum, i. 17), and Engler and Prantl (Die Natürl. Pflanzenf. iii. ii. 18). In the following brief notes the present writer gives reasons for separating the group from the true* *Magnoliaceae*, represented by the genera *Michelia*, Linn., *Manglietia*, Bl., *Talauma*, Juss., *Aromadendron*, Blume, *Magnolia*, Linn., and *Liriodendron*, Linn. This segregation has become more imperative since the *Trochodendraceae* and *Himantandraceae* have been taken out of *Magnoliaceae*, and some degree of uniformity of treatment is now possible.

Robert Brown† was the first to point out that the genera *Illicium* and *Drimys* should be distinguished as a separate family from *Magnoliaceae*, and for them he proposed the name *Wintereae*. Lindley, for a time, and J. Miers took a similar view, as did also Endlicher, who expressed the opinion (Enchir. Bot. 428), that the group ought to rank as an independent family, although later (Genera Plantarum 836), he included them as a sub-family of *Magnoliaceae*. Even J. D. Hooker and T. Thomson (Fl. Ind. 72), say that "the *Wintereae* form a very questionable tribe of *Magnoliaceae*, and may with reason be separated from them." Hooker, however, as already indicated, included them in the *Magnoliaceae*.

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* Other genera referred to the *Magnoliaceae* are *Trochodendron*, Sieb. et Zucc., and *Euptelea*, Oliv., which constitute the distinct family *Trochodendraceae*, and *Cercidiphyllum*, Sieb. et Zucc. the *Cercidiphyllaceae* *Eucommia*, Oliv., and *Tetracentron*, Oliv., are better placed with the *Hamamelidaceae*, whilst *Himantandra*, F. Muell. (= *Galublimima*, Bailey), a remarkable genus incorrectly reduced by Mueller himself to *Eupomatia* (*Annonaceae*), has recently been made the type of a new family, *Himantandraceae* (*see* Diels "Über die Gattung *Himantandra*, ihre Verbreitung und ihre systematische Stellung," in Engl. Bot. Jahrb. lv. 126–131, fig. i (1917)).

† R. Br. apud DC. Syst. Veg. i. 548 (1818); De Candolle, however, treated them as a tribe, *Illiceae* of *Magnoliaceae*.

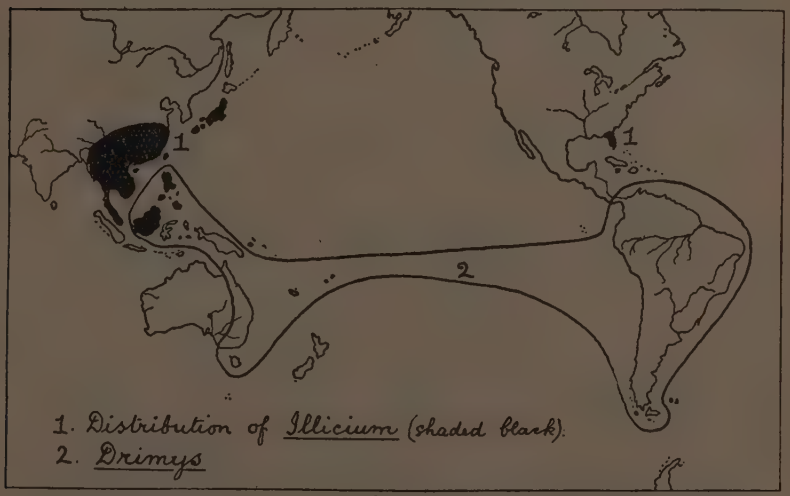
Although the *Winteraceae* are allied to the *Magnoliaceae* and may have had a similar origin, they are considerably more advanced from an evolutionary point of view, and they are very definitely distinguished from them by the following characters :— (1) absence of stipules; (2) secretory cells filled with resin or ethereal oil in the leaves, appearing as transparent dots; (3) very short and small floral axis; (4) relatively few stamens with small divergent anther-cells; (5) few carpels in a single whorl (or very rarely in 2 whorls), sometimes reduced to a single carpel; and there are corresponding differences in the fruits. I give here a key to the families more closely related to *Magnoliaceae*, and the group may take ordinal rank as *Magnoliales* :—

*Perianth present, conspicuous, never operculate; indumentum not lepidote :
Flowers hermaphrodite; stamens free :
Leaves stipulate, the stipules often enclosing and protecting the young growths; flowers large, solitary, terminal or rarely axillary; axis elongated and cone-like, especially in fruit; floral parts spirally arranged - - - - **Magnoliaceae.**
Leaves exstipulate, pellucid punctate; flowers small or medium-sized, rarely solitary; axis short and never cone-like in fruit; carpels more or less in a single whorl - **Winteraceae.**
Flowers unisexual; stamens partially or wholly connate into a globose mass; leaves exstipulate, often pellucid-punctate; trailing shrubs - - **Schizandraceae.**
Perianth present, operculate; indumentum lepidote; stamens petaloid - **Himantandraceae.
***Perianth absent or much reduced and bract-like; indumentum never lepidote; stamens not petaloid :
Carpels 3; stipules large and interpetiolar, membranous; leaves minutely pellucid - punctate; flowers polygamo-monoecious; monotypic genus (*Lactoris*) in Juan Fernandez - - **Lactoridaceae.**
Carpels more than three; stipules absent or small; Leaves not pellucid-punctate; East Asiatic trees and shrubs :
Flowers hermaphrodite, clustered or racemose-paniculate; seeds not winged - - - **Trochodendraceae.**

Flowers dioecious, solitary on short arrested branchlets; stipules adnate to the petiole, seeds winged - - - **Cercidiphyllaceae.**

Our knowledge of the family *Winteraceae* is still far from complete and much more collecting of the Australasian and South American species is desirable. With commendable perspicacity, however, considering the material available, the late Prof. Van Tieghem has separated two or three small genera from *Drimys*, which further study will probably show to be fully justified.

Geographical Distribution.—*Winteraceae* have, in contrast with the true *Magnoliaceae*, a much more tropical and southerly distribution. They are absent from Europe, Africa, Central Asia, and Western North America. The largest and most widely spread genus is *Drimys*, representing, however, a very homogeneous group of species distributed from the Malay Archipelago through Eastern Australia to Tasmania, and ranging widely in South America, from Costa Rica to Tierra del Fuego, including the island of Juan Fernandez. The distribution of *Drimys*,



therefore, seems to point to considerable antiquity, connecting as it does two widely separated areas in the Southern Hemisphere (*see* map); and in floral structure it has a slight tendency to unisexuality and reduction so fully carried out in the case of the *Schizandraceae*. *Illicium* again, has an interesting distribution closely resembling that of *Magnolia* and *Liriodendron*, but more subtropical. It is also a natural genus of closely allied species and must be of great age. It is confined to the Northern Hemisphere, from Assam to Japan and south to Borneo in the Old World, whilst in America it occurs only in Florida. *Illicium*

thus connects the floras of two widely separated areas in the Northern Hemisphere. The remainder of the genera are small and of very restricted range, *Wintera* in New Zealand, *Bubbia* in Lord Howe's Island and New Caledonia, and *Belliolum*, *Exospermum* and *Zygogynum* in New Caledonia.

Economic Products.—" Winter's Bark " from *Drimys Winteri*, Forst., South America; much used in Brazil as an astringent and stimulant. " Star Anise," ripe fruit of *Illicium verum* (*see Kew Bull.* 1888, 173 and figure), a native of South West China; condiment and spice and used for flavouring; fruit also contains a volatile oil distilled in large quantities by natives of Langson; this oil is used in cough mixtures (Greenish, Mat. Med. ed. 2, 106, 275 (1909). *Wintera axillaris* is aromatic and pungent and its wood serviceable for inlaying (Cheeseman, Fl. N. Zeal. 29).

Principal literature relating to the Winteraceae.—J. Miers, " On the Winteraceae," Ann. & Mag. Nat. Hist. ser. 3, ii. 33–48, 109–115 (1858); and Contrib. to Bot. i. 123–145, pl. 25–27 (1851–61). Lindley, Nat. Syst. Bot. 26 (1830); ed. 2, 17 (1836); Veg. Kingd. 417 (1846) (under *Magnol.*). Endlicher, Gen. Pl. 836 (1836) (under *Magnol.*). Eichler in Mart. Fl. Bras. xiii. i. 129–139, tt. 30–32 (1841). Benth. & Hook. f. Gen. Pl. i. 17 (under *Magnol.*). J. Tambon, " des Illicium en général de la Badiane et de son Huille essentielle en Particulier " pp. 77, pl. 1–4 (Montpellier 1886). Prantl in Engl. & Prantl, Nat. Pflanzenf. iii. ii. 18, fig. 17 (1891); Nachtr. ii. 108–9 (1906) (under *Magnol.*). P. Parmentier, " Histoire des Magnoliacées (Tribe Illiciees) " in Bull. Sci. Fr. et Belg. xxvii. 159–337 (1895); Van Tieghem, Journ. de Bot. xiv. 275 et seq. (1906).

Description of Winteraceae. Trees or shrubs with exstipulate alternate or rarely subverticillate aromatic pellucid-punctate evergreen leaves. Flowers rather small, in axillary or terminal fascicles or umbellate cymes, of various colours. Floral axis very short, with the parts of the flower arranged more or less in whorls. Perianth double. Sepals 2–6, free and imbricate, or united and rupturing valvately. Petals in 2—several series, imbricate, often conspicuous in bud. Stamens several, in one or several series, hypogynous; anthers introrse. Carpels in a single whorl or rarely subbiseriate, 1—many, free or rarely united, 1—many-ovuled; stigma sessile or on a distinct style. Fruit capsular or baccate. Seeds with copious endosperm and minute embryo.

Anatomical features.—Mainly those of true *Magnoliaceae*. The leaves are markedly papillous and glaucous below in nearly all the species. They contain secretory cells which are filled with resin or ethereal oil, and these are visible especially in young leaves, appearing as translucent dots. *Drimys* is remarkable in having no vessels in the xylem, a feature common to the *Gymnosperms*, and the wood resembles very much that of the *Araucarieae* especially. It consists entirely of wood prosenchyma, the elements of which have bordered pits and are square

in cross section. The perforations of the vessels in the family (when present) are scalariform with very numerous bars, much more numerous than in the true *Magnoliaceae* (*see* Solereder, System. Anat. Dicot. engl. ed. i. 31 (1908).

Characters occurring in few genera and species.—Leaves subverticillate (in threes) in *Drimys rosea*, Ridl. (New Guinea). Inflorescence a single terminal sessile flower in *Zygogynum Vieillardii*, Baill. (New Caledonia); of three simple terminal pedicels in *Exospermum* and *Zygogynum* spp.; of several pedicels in *Drimys* spp.; a terminal cluster of cymes in *Bubbia* and *Drimys* spp.; pedicels narrowly winged in *Drimys parviflora*, Ridl. Calyx completely closed in bud in *Drimys;* imbricate in *Illicium*. Carpels united in tribe *Exospermeae;* capsular, beaked and stellate in *Illicium;* reduced to one in *Drimys dipetala*, F. Muell., and *Zygogynum pomiferum*, Baill.

Genera 7; Species 62.

Distribution.—Eastern India to Japan and New Zealand, Florida, Central and South America.

Key to Genera.

Sepals imbricate; carpels free from one another, spreading, compressed laterally and stellately arranged in fruit — Tribe I. Illiceae.
Only genus — 1. **Illicium.**
Sepals valvate; carpels more or less erect:
*Carpels free, especially in fruit — Tribe II. Drimydeae.
Calyx enclosing the petals in bud and at length rupturing — 2. **Drimys.**
Calyx exposing the petals in bud, small and more or less cup-like:
Flowers solitary and axillary; petals 5–6 — 3. **Wintera.**
Flowers in a terminal cluster of many-flowered cymes; petals 10–14:
Inner series of petals 4–6; stamens with two widely divergent anther-cells — 4. **Bubbia.**
Inner petals 10; stamens with linear and parallel contiguous anther cells — 5. **Belliolum.**
**Carpels more or less united, especially in fruit — Tribe III. Exospermeae.
Carpels 7–8, with conspicuous grooves between them in fruit, partially united — 6. **Exospermum.**
Carpels 1–4, closely united, each separated by a very thin wall — 7. **Zygogynum.**

1. **Illicium,** *Linn.* Syst. ed. x. 1050 (1759).—About 20 species, in Indo-Malaya, China, Japan, Florida (*see* map). Type species: *Illicium anisatum*, Linn., Japan and China.—Benth. & Hook.

f. Gen. Pl. i. 18. Prantl in Engl. & Prantl, Pflanzenf. iii. ii. 18. J. Tambon, l.c. (*see* p. 188).

2. **Drimys,** *Forst.* Char. Gen. 83, t. 42 (1776).—About 20 species, Malay Archipelago to East Australia and New Caledonia, Central and South America (*see* map). Type Species: *Drimys Winteri*, Forst., South America—Benth. & Hook. f. Gen. Pl. i. 18. Prantl in Engl. & Prantl, Fflanzenf. iii. ii. 19.—For critical account of the South American species see Miers in Ann. & Mag. Nat. Hist. ser. 3, ii. 42 (1858). For discoursive account of *Drimys* see Van Tieghem in Journ. de Bot. xiv. 280 (1900), a summary of which appears in Engl. & Prantl, Pflanzenf. Nachtr. ii. 108 (1906).

3. **Wintera,** *Forst.* Fl. Ins. Austr. Prodr. 42 (1786), non Murr.—3 species, New Zealand. Type species: *Wintera axillaris*, Forst.—Cheeseman, Fl. N. Zeal. 29 (as *Drimys*).

4. **Bubbia,** *Van Tiegh.* in Journ. de Bot. xiv. 278, 293 (1900). —7 species, 5 in New Caledonia, 2 in Lord Howe's Island.

5. **Belliolum,** *Van Tiegh.* l.c. 278, 330 (1900).—4 species in New Caledonia.

Exospermum stipitatum, Van Tiegh. A. outer and closely connivent petals. B. flower with petals removed. C. stamen. D. section of carpel. E. ovule. F. young fruit.

6. **Exospermum,** *Van Tiegh.* l.c. 279, 333 (1900).—2 species, New Caledonia.—Type species: *Exospermum stipitatum* (*see* text figure).

7. **Zygogynum,** *Baill.* Adansonia, vii. 298 (1867).—6 species, New Caledonia. Type species: *Zygogynum Vieillardi.*

XXI.—NEW OR NOTEWORTHY SOUTH AFRICAN PLANTS. (II.)

Joseph Burtt-Davy.

21. **Elephantorrhiza obliqua,** *Burtt-Davy* [Leguminosae-Adenanthereae]; *E. Burchellii,* Benth., affinis, sed foliolis paucioribus latioribus obliquis, calycis lobis longioribus et caulibus puberulis differt.

Suffrutex perennis. *Caules* annui, e collo crescentes, circiter 6 dm. alti, striati, puberuli. *Folia* 4–5-juga; pinnae 13–16-jugae; rhachis rhachillaeque sparse pilosae; foliola 1·2–1·3 cm. longa, 3–4 mm. lata, valde obliqua, mucronata, glabra; costa prominens. *Racemi* subsessiles, 6–7·5 cm. longi, ex axillis foliorum inferiorum crescentes; pedicelli 1 mm. longi. *Calycis* lobi acuminati. *Legumen* non vidi.

South Africa. Transvaal: Carolina Dist., High-veld between Carolina and Oshoek, at an out-span about 1 mile from Robinson's, in open grass-veld about 1650 m., Jan. 10, 1905, *Burtt-Davy* 2976 *in herb. Mus. Brit.*

22. **Plectronia ovata,** *Burtt-Davy* [Rubiaceae-Vanguerieae]; *P. glaucae,* K. Schum., et *P. spinosae,* Klotzsch, affinis.

Frutex spinosus; spinae tenues. *Petioli* tenues, 4–6 mm. longi. *Laminae* late ovatae, obtusae vel aliquando attenuatae, ad basim truncatae, 2·5 cm. longae, fere 2·5 cm. latae, glabrae, subter glaucescentes. *Pedunculi* tenues, glabri, 1·2–1·9 cm. longi, 10–20-flori; pedicelli tenues, cymoso-fasciculati, glabri, 6–7 mm. longi. *Corollae* fauces barbatae; lobi reflexi, 2·5 mm. longi, glabri, intus pallentes. *Filamenta* inclusa; antherae exsertae. *Stylus* 2·5 mm. exsertus, 2-lamellatus. *Ovarium* glabrum.

South Africa. Transvaal: near Barberton, Dec. 29, 1903 (in flower), *T. C. Legge in herb. Transv. Dep. Agric. No.* 1728 *and* 1729. The type is No. 1729 *in herb. Bolus.*

23. **Plectronia foliosa,** *Burtt-Davy* [Rubiaceae-Vanguerieae]; species distincta, ramulis robustis foliosis, foliis magnis.

Arbor parva, ramulis robustis puberulis aliquanto quadrangularibus. *Stipulae* triangulo-acuminatae, circiter 1·2 cm. longae. *Petioli* 1·2–1·8 cm. longi, puberuli. *Laminae* 9–11·5 cm. longae, 3–5 cm. latae, supra puberulae, subter tomentosae, apice acutae vel apiculatae, basi in petiolum gradatim attenuatae; nervi subter prominentes, puberuli; nervi laterales pinnatim dispositi, angulo inter nervos et costam acuto. *Pedunculi* circiter 1·3 cm. longi, pubescentes, cymoso-ramosi, ad apicem ramulorum aggregati, circiter 5 cm. longi; pedicelli breves, circiter 6 mm. longi. *Flores* non vidi.

South Africa. Transvaal: Waterberg Dist., Warm Baths, about 1080 m., January 1906, *Burtt-Davy* 5161 (*in herb. Bolus*).

24. **Plectronia Junodii,** *Burtt-Davy* [Rubiaceae-Vanguerieae]; *Canthio livido*, Hiern, affinis, sed frutex major pubescens, foliis exsiccando minus nigrescentibus, basi abrupte rotundatis vel truncatis, cymis minoribus congestis, corollae lobis duplo longioribus differt.

Frutex 1·5–3 m. altus; ramuli patentes, circiter 15 cm. longi; ramuli, petioli, pedunculi, pedicelli, folia juvenilia et costae foliorum seniorum pubescentes. *Foliorum* petioli 6 mm. longi; laminae 4·5–6·5 cm. longae, 3·2–3·8 cm. latae, ovales, apiculatae vel acutae, basi abrupte rotundatae vel truncatae. *Pedunculi* aliquanto pauciflori; pedicelli ad 4 mm. longi, tenues. *Flores* 3 mm. longi. *Corollae* tubus glaber, fauce tomentosa; lobi 2 mm. longi.

South Africa. Transvaal: Pietersburg Dist., Shilouvane, "ravin du Masetane," *Junod* 720 *in herb. Kew* (type).

Trop. Africa. Nyasaland: Zomba and vicinity 840–1140 m., *A. Whyte*. Gazaland (Port E. Africa), Madanda Forest, *Swynnerton* 2154.

25. **Pterocelastrus Galpinii,** *Loesen.* var. **parvifolia** *Burtt-Davy* [Celastraceae—Celastreae]; frutex, a forma typica ramis angulosis, foliis subsessilibus 2–3 cm. longis 6–9 mm. latis anguste oblongis coriaceis glabris, costis infra prominentibus, pedunculis paucifloris 5 mm. longis vel minus, fructibus subsessilibus 5–6 mm. longis prope apicem tuberculatis differt.

South Africa. Transvaal: Pietersburg Dist., Houtbosch, *Rehmann* 6055 *in herb. Kew.*

26. **Rhynchosia confusa,** *Burtt-Davy* [Leguminosae-Phaseoleae]; *R. nervosae*, Benth., et *R. hirsutae*, E. et Z., affinis, sed pedunculis paucifloris brevioribus, foliolis minoribus obtusioribusque pubescentibus non fulvidis distincta.

Herba perennis, prostrata, caulibus puberulis. *Folia* canopubescentia, reticulata; costae infra prominentes. *Stipulae* subulatae. *Petioli* 0·5–1 cm. longi. *Foliola terminalia* obtusa, retusa, apiculata vel subacuta, 1·3–2 cm. longa, 1·2–1·6 cm. lata, petiolulis 5 mm. longis. *Pedunculi* tenues, foliolis breviores vel parce excedentes, floribus paucis (2–4); pedicelli tenues, breves (1–2 mm. longi). *Flores* circiter 8 mm. longi. *Calycis* lobi lanceolati, acuminati, pubescentes. *Corolla* glabra, calycis tubo circiter 3 mm. longior. *Legumen* puberulum, circiter 2 cm. longum et 7 mm. latum.—*R. nervosa* var. *pauciflora*, Harv. in Fl. Cap. ii. p. 253 (1861–62).

South Africa. Transvaal: Pretoria Dist., Magalies River, *Zeyher* 510 *in herb. Cantab.* (type); Aapjes Riv. and Vaal Riv. (the latter in the Potchefstroom District) *Zeyher*, 508, 511. Orange Free State: Kroonstad Dist., Rhenoster Kop, *Zeyher*. British Bechuanaland: Kuruman Dist., near the Kuruman and

Moshowing Rivers, *Burchell* 2298, 2457 and 2548 B; Vryburg Div., near Geluk, *Burtt-Davy* 11,121.

27. **Rhynchosia Burkei,** *Burtt-Davy et Baker fil.* [Leguminosae-Phaseoleae]; species petiolis longis, foliolis terminalibus obovatis obtusis retusis vel apiculatis, subter sparse et pallide glandulosis, et racemis quam foliolis brevioribus et paucifloris distinguitur.

Caules prostrati, robusti, striati, pubescentes. *Stipulae* lanceolatae, acuminatae, striatae. *Petioli* 2·25–3 cm. longi. *Foliola terminalia* obovata, obtusa retusa vel apiculata, sparse ciliata, 2–3 cm. longa, circa 2·5 cm. lata, petiolulis 1 cm. longis; foliola lateralia obliqua; pagina superior glabra et sparse reticulata; pagina inferior sparse glandulosa, costa et nervis secundariis prominentibus et sparse pilosis, foliolorum juvenilium nervis tomentosis. *Racemi* axillares, foliolis breviores, pauciflori; pedicelli 1 mm. longi. *Calycis* lobi lanceolati, acuminati, pubescentes. *Corollam* non vidi.—*R. adenodes* var. ? *robusta*, Harv. in Fl. Cap. ii. p. 254 (1861–2).

South Africa. Orange Free State: Thabanchu, *Burke in herb. Kew* (type); *Zeyher* 509 *in herb Cantab.*

28. **Rhynchosia Harmsiana,** *Schlechter* var. **Burchellii,** *Burtt-Davy* [Leguminosae-Phaseoleae]; *R. gibbae*, E. Mey., affinis, sed caulibus tenuioribus, foliolis minoribus obtusis, bracteis minoribus, floribus multo minoribus, carinis concoloribus differt.

Herba tenuis, volubilis, pubescens. *Caules* tenues, pilis brevibus retrorsis pubescentes. *Petioli* 1·3–1·8 cm. longi; petiolulus folioli terminalis 2–4 mm. longus. *Foliola* acuta vel obtusa, supra et nervis infra minute strigosa, subter glandulis pallide fulvis sparse glandulosa; foliola lateralia obliqua; terminalia aliquanto rhomboidea, 1·3–2 cm. longa, 0·9–1·5 cm. lata. *Pedunculi* foliis longiores, 5–7·5 cm. longi, floribus paucis (5–7) distantibus; pedicelli circiter 2 mm. longi. *Calyx* glandulis punctatus; lobi breves, lati, acuti; infimi multo longiores et subulato-acuminati. *Corolla* 5 mm. ultra calycem exserta, fulva; vexillum glabrum, purpureo-brunneo-striatum; carina concolor. *Legumen* strigosum, sparse hirsutum; rostrum tenue, ad 2 mm. longum.

South Africa. Cape Province: near Komgha, 600 m., a small climber among shrubs, *Flanagan* 796 *in herb. Kew* (type): Van Stadensberg, *Burchell* 4746; Kentani, *Pegler* 2032; Humansdorp Div., Kromme River, *Burchell* 4860. East Griqualand: near Clydesdale, 750 m., climbing on shrubs, *Tyson* 2073. Natal: Umzumbi, *Medley Wood* 3143.

29. **Rhynchosia Pentheri,** *Schlechter*, var. **Hutchinsoniana,** *Burtt-Davy et Baker fil.* [Leguminosae—Phaseoleae]; *R. Pentheri*, Schlechter, affinis, sed foliis sessilibus vel subsessilibus, calycis lobis hirsutis plus minusve glandulosis differt.

Herba robusta, prostrata; caules striati, pilis patentibus hirsuti. *Folia* sessilia vel subsessilia, supra sparse strigosa,

infra in nervis sparse setulosa; nervi infra prominentes; foliolum terminale, brevissime petiolulatum, rotundatum, obtusum, 3–3·4 cm. longum, 3–3·3 cm. latum; foliola lateralia obliqua. *Racemi* ad 15 cm. longi, floribus plus minusve laxe racemosis; pedunculi 7–10 cm. longi, glanduloso-hirsuti; pedicelli 2–5 mm. longi. *Flores* circiter 1 cm. longi; calyx hirsutus, plus minusve glandulosus; lobi longe acuminati, corolla immatura longiores. *Corolla*: carinae apex purpureus; vexillum flavum, purpureo-striatum. *Legumen* non vidi.

South Africa. Natal: Karkloof, 900–1200 m., *J. Wylie in herb. Wood* 7212; Edendale, 900–1200 m., amongst grass on hills, *Wood* 4601; Van Reenen, 1500–1800 m., on hillsides, *Wood* 6674; near Northdene, 150 m., Wood 3180. East Griqualand: in grassy places near Clydesdale, 750 m., *Tyson* 2068.

30. **Conyza pinnatifida,** *Less.* Syn. Comp. p. 204 (1832).

South Africa. Transvaal: Groenkloof, Pretoria, Sept. 1920, *van Dam in Transv. Mus. Herb.* 12,003 (vide Mrs. Pott *in Ann. Transv. Mus.* vi. pt. 4, pp. 119–135); Waterberg Dist., on the farm "Twenty-four Rivers," Nov. 1919, a garden weed, *Burtt-Davy*, 18,209.

This is a Cape Province Composite of recent introduction into the Transvaal, Mrs. Pott's being the first record of its occurrence. Twenty-four Rivers is an isolated cattle ranch some 40 miles or more N.N.W. of the railway at Nylstroom, away from any main road, and about 80 miles north of Pretoria. Not a single specimen of the plant was seen on the 40 miles of road from Nylstroom, which runs through a thinly populated area with but little cultivation. The early appearance of this weed so far from Mrs. Pott's locality suggests a tendency to spread rapidly. The seeds may have been carried with plants from some nursery, or by cattle—there has been a large influx of cattle into the Waterberg district in the last two or three years. The achenes are readily wind-distributed, and the plant may become as troublesome a weed as *Erigeron linifolius* now is.

31. **Salsola foetida,** *Del.;* Fl. Cap. v. Sect. 1, p. 452.

South Africa. Transvaal: Bloemhof Dist., farm "Kaffraria" near Christiana, Mch. 1912, gregarious, forming a colony in "brak" (i.e. saline) soil, *Burtt-Davy* 12,800 *in herb. Bolus.*

One of the plants called "Ganna-bosch." An interesting extension of known range. This appears to be a rare plant in South Africa, or rarely collected, only one specimen being cited in the *Flora Capensis* (*Bolus* 596, from Graaf Reinet); my specimens were but a few inches high, instead of "1–4 ft." as described for the species, and lacked the foetid, fishy smell mentioned by Dr. Bolus on his label. I am indebted to Mrs. Frank Bolus for the determination. Outside S. Africa it is found in Tropical and North Africa, Western Asia, and India.

32. **Chenopodium glaucum,** *Linn.* Sp. Pl. ed. 1, p. 320 (1753)

South Africa. Transvaal: Heidelberg Dist., Burttholm near Vereeniging, about 1450 m., plentiful on dried mud of a dam, *Burtt-Davy* 18,155 *in herb. Bolus*; Standerton Dist., Paardekop, about 1690 m., in wet places, *Schlechter* 3448 *in herb. Kew.*

Common in many parts of Europe and temperate Asia and along the coast of Australia; sporadic in other parts of the globe. My specimens agree well with some collected at Hudson's Bay by Burke and in the Chonos Archipelago by Darwin, both in herb. Kew. In Colorado, U.S.A., *Chenopodium glaucum* is found in "damp alkaline soil" (*Eastwood*), and in Saskatchewan Bourgeau collected it "dans les marais salés de la prairie." In Tasmania it is said to be "common on the sea-coast near high-water mark." The dam at Burttholm, where my specimens were found, is but very slightly "brak" (*i.e.*, saline) and the other plants with which they were there associated are not halophytes; the Paardekop habitat is not likely to be saline owing to heavier rainfall and better drainage. Though the plant is halophytic in the sense that it tolerates saline soils, it does not appear to be a true halophyte, but rather a hydrophyte which thrives in somewhat saline spots, perhaps not because of their salinity but because they are moist and unshaded and furnish ample space for small species of prostrate habit.

33. **Chenopodium carinatum,** *R. Br.* Prodr. p. 407 (1810).

South Africa. Transvaal: Heidelberg Dist., Burttholm, 9 miles from Vereeniging, naturalized on a gravel drive, Mch. 1917, *Burtt-Davy*, 17,224 *in herb. Bolus.*

An annual prostrate herb, native of Australia, New Zealand and New Caledonia. Not previously recorded for S. Africa Probably introduced with Australian garden seeds.

34. **Potamogeton nodosus,** *Poir.* in Lam. Encycl. Suppl. iv. p. 535 (1861). *P. fluitans*, Auct. non Roth.

South Africa. Transvaal: Heidelberg Dist., Klip River at Kookfontein near Vereeniging, October 1915 and December 1919, in deep, still pools (associated with *P. crispus*, *P. badius* and an *Aponogeton*) *Burtt-Davy* 15,389, 18,175 and 18,176. Mr. Bennett has kindly studied my specimens and says of this species: "Distributed under many names. Hagström (*Anat. Stud. Pot.* 1916, pp. 183–199) gives the best account of the plant yet given, although I do not agree with all his references to other names. The plant is distributed over Europe, N. America, Africa, Asia (rare) and perhaps the Marianne Islands. It has constantly been mixed up with *P. fluitans* Roth. (a hybrid), and Hagström was the first to really separate the various mixings."

35. **Potamogeton crispus,** *Linn.* Sp. Pl. ed. 1, p. 126 (1753).

South Africa. Transvaal: Heidelberg Dist., Klip River at Kookfontein near Vereeniging, Dec. 1919, *Burtt-Davy* 18,178. Mr. Bennett says: "In habit this is much like the Australian being smaller, with narrower leaves, etc., than the European

specimens. The only specimens I have before seen from the Transvaal are in the Delessert Herbarium at Geneva, viz., *Wilms* No. 1658, and this is named by Graebner in Engler's Pflanzenreich, Heft. 31, 1907, p. 100 as var. *najadoides*, giving as characters: 'Planta gracilis. Caulis tenuis. Folia remota, angusta, ca. 3 cm. longa, valde crispa. Spica pauciflora, dein recurvata.' Your plant has not 'folia remota' nor 'spica recurvata'."

36. **Potamogeton badius,** *Hagström* Crit. Res. Pot. p. 104 in K. Svensk. Vet.-Akad. Handl. lv. No. 5, (1916). *P. pusillus* Auct. non Linn. Founded on Drége 4458 from "Cap. bon. Spei."

South Africa. Transvaal: Heidelberg Dist., Klip River at Kookfontein near Vereeniging, Dec. 1919, *Burtt-Davy*, 18,177; Lydenburg, *Wilms* 1656 and 1657, Dec. 1894, *in herb. Delessert and herb. Bennett.* Natal: *Medley Wood* 3055, sub nom. *P. obtusifolius in herb. Kew* and *herb. Bennett.* Cape Province: Buffalo River, King Williams Town, Apl. 7, 1885, *J. Leighton in herb. Kew* and *herb Bennett;* "In (cap) bon spei" *Mundt and Maire* (sub nom. *P. pusillus*) *in herb. Berlin;* teste A. Bennett in litt.

37. **Peponia caledonica,** *Cogn.* in DC. Monogr. Phan. iii. p. 410 (1881). *Luffa caledonica* Sond. in Fl. Cap. ii. p. 490 (1861–62).

South Africa. Transvaal: Witwatersrand, Houghton Ridge, Johannesburg, about 1710 m., May 31, 1915 (in fruit), *Burtt-Davy* 15,262 *in herb. Bolus.* Orange Free State: Wolve Kop, near the Caledon River (the type locality), *Burke* 305 and *Zeyher* 589 *in herb. Kew;* near Bethlehem, *Bolus* 8162; Winburg Dist., Doorn Kop, *Burke.* Basutoland: *Cooper.* Cape Province: near Cradock, *Cooper;* Graaf Reinet Div., near Wagenpad's Berg (on the southern side), *Burchell* 2837.

The Transvaal locality is an interesting northerly extension of known range. The leaves vary much in depth of sinus, but the Johannesburg plant compares well with the type.

38. **Scandix Pecten-Veneris,** *Linn.* Sp. Pl. ed. 1, p. 256 (1753).

South Africa. Transvaal: Government Experiment Farm, Potchefstroom, Oct. 1909, *Burtt-Davy* 5590 in *Transv. Dep. Agric. herb.* A cornfield weed, adventive from Europe. It is distributed through Europe, N. Africa, W. Asia, to N.W. India, and is also naturalized in N. America.

39. **Tournefortia tuberculosa,** *Cham.* in Linnaea, iv. p. 467 (1829). *Heliotropium tuberculosum*, Guerke in Engl. & Prantl., Nat. Pflanzenfam. iv. 3a, p. 94 (1893), non Boiss.

South Africa. Transvaal: Bloemhof Dist., farm Kaffraria near Christiana, Mch. 1912, *Burtt-Davy* 12,820 *in herb. Bolus.* "Flowers creamy-white, small." This is an interesting addition to our flora as it is distinctly a Karroo ("Central Region") species, found in the Prince Albert, Colesberg, Victoria West and

Calvinia Divisions, extending north to Great Namaqualand, tropical S.W. Africa and Griqualand West.

In *Index Kewensis*, Suppl. 1, p. 200 this species is referred to as "*Heliotropium tuberculatum*, Guerke = *Messerschmiedtia tuberculata* Cham." The entry should read "*H. tuberculosum*, Guerke = *Tournefortia tuberculosa*, Cham."

40. **Polygonum plebeium,** *R. Br.* Prodr. p. 420 (1810). *P. herniarioides*, Del. Resembling forms of *P. aviculare*, Linn. in habit, and easily confused with it in the flowering state; equally polymorphic. Stem trailing; internodes short; minutely scaberulous (sometimes smooth ?); leaves linear-oblong, 4–10 mm. long, minutely scurfy or glandular, especially below; midrib prominent, lateral nerves obscure; stipules lacerate; nerve mostly 1 (rarely 2 or more or 0); fruit rhomboid, blackish-brown, smooth, shining.

Tropical Africa. Transvaal; north through S. Rhodesia (Gwelo), Abyssinia, Egypt and Tropical Asia.

Hooker (*Fl. Brit. Ind.* v. p. 28; 1886) includes "S. Africa" in the range of distribution of this species, probably on the strength of Drége's specimen from the Victoria West Div. ("Nieuwe Veld") which Drége named *P. herniarioides*. Drége's plant has been referred to *P. aviculare*, Linn., but though the specimen is immature I am inclined to the opinion that Drége was right in his determination; the leaves have the peculiar scurfy cuticle of *P. plebeium;* though the nerves of the ochreae are more numerous than in typical *plebeium*, the variety *polyneura*, Hook. f. has equally numerous nerves, and further agrees in the long, narrow and revolute leaves.

Var. **micranthemum,** *Hook. f.* Fl. Brit. Ind. v. p. 29 (1886). Small, slender, lax and somewhat flaccid; leaves 6–8 mm. long, linear or linear-oblong, narrowed to the base, obtuse to acute, flat; flowers small; pedicel 1–2 mm. long, 2 mm. broad; sepals narrow, green with white margins; fruit about 1 mm. long or less, blackish-brown.

South Africa. Transvaal: Waterberg Dist., Tamboties River, 960 m., common on wettish alluvial ground, overflowed during rains, Dec. 1919, *Burtt-Davy* 18,309. Agrees well with Wallich's 1691/5 (from the banks of the Irrawaddi) and 1691/4 (from Kumaon).

XXII.—NOTES ON RAIMANNIA AND ALLIED GENERA.

T. A. Sprague and L. A. M. Riley.

The genus *Oenothera*, as founded by Linnaeus in 1753, included three species, *biennis*, *mollissima* and *fruticosa*.* Many others, some of very different type, were added during the next 80 years, and *Oenothera* became so comprehensive that in 1835 Spach divided it into fifteen genera.† Eight of these were reduced by Endlicher‡ in 1840, and the remaining ones by Bentham and Hooker in 1862.§ Raimann, however accepted Spach's genera in his revision of the *Onagraceae*, published in 1893‖; and Small adopted the same classification in 1896.¶

Spach restricted *Oenothera* to *Oe. mollissima* and its allies, and placed *biennis* and *fruticosa* in *Onagra* and *Kneiffia* respectively. Rose pointed out, in 1905** that *biennis* should be regarded as the nomenclatural type of *Oenothera*. That this view is correct is evident from the following considerations.

1. Linnaeus based *Oenothera* on *Onagra*, Tourn. Inst. i. p. 302, t. 156. Tournefort included in his description the phrase "seminibus ut plurimum angulatis," which is applicable to *biennis*, but not to *mollissima* or *fruticosa*. Linnaeus also described the seeds as angled.

2. *Oe. biennis* was better known to Linnaeus than either *mollissima* or *fruticosa*, being common in Europe, both as a naturalized plant and in gardens.

3. It was included by Linnaeus in his Hortus Upsalensis and Hortus Cliffortianus.

Such considerations are in accordance with Art. 19 and 45 of the International Rules, and are recognised as valid in the American Code, which is more explicit.

Onagra, Adans., being a synonym of *Oenothera*, Linn. (emend.), Rose proposed the new generic name *Raimannia* for *Oenothera*, Spach. He cited *Oe. laciniata* as the type species. But if "the publication of a new generic name as an avowed substitute for an earlier invalid one does not change the type of a genus,"†† *Oe. mollissima* should be regarded as the type of *Raimannia*.

The three genera *Oenothera*, *Raimannia* and *Anogra* (*Onagreae-Oenotherinae*) are closely allied, and to a certain extent con-

* Sp. Pl. ed. 1, p. 346; Gen. Pl. ed. 5, p. 163.
† Hist. iv. p. 353; Ann. Sc. Nat. sér. 2, iv. p. 164; Nouv. Ann. Mus. Hist. Nat. iv. p. 341.
‡ Gen. Pl. p. 1190.
§ Gen. Pl. i. p. 789.
‖ Engl. et. Prantl, Nat. Pflanzenfam. iii. 7, pp. 199–223.
¶ Bull. Torr. Bot. Cl. xxiii. p. 167.
** Contrib. U.S. Nat. Herb. viii. p. 330.
†† Bull. Torr. Bot. Club, xxxiv. p. 173; Science, n.s.xlix. p. 334 (1919).

nected by aberrant species. Typical species have the following characters :

Oenothera. Flower-buds erect. Flowers nocturnal. Petals yellow. Ovules horizontal, 2–4-seriate. Seeds prismatic.
Raimannia. Flower-buds erect. Flowers nocturnal. Petals yellow. Ovules ascending, biseriate. Seeds subterete.
Anogra. Flower-buds drooping. Flowers diurnal. Petals white, turning pink. Ovules ascending, uniseriate. Seeds subterete.

It will be seen that *Raimannia* has certain characters of *Oenothera* and others of *Anogra*. *Oenothera* has horizontal ovules and strongly angled seeds, whereas *Raimannia* and *Anogra* have ascending ovules and subterete seeds. On the other hand *Oenothera* and *Raimannia* have erect flower-buds and yellow flowers, while *Anogra* has drooping flower-buds and white or pink flowers.

Oenothera (*Onagra*) was stated by Raimann to be confined to North America, but it is represented in the Andes of Bolivia and Peru by at least four species, *Oe. coccinea*, Britton,* *Oe. fusca*, Sprague et Riley, comb. nov. (*Onagra fusca*, K. Krause), *Oe. serratifolia*, K. Krause, and *Oe. scabra*, K. Krause.† Britton stated that *Oe. coccinea* is related to *Oe. mollissima* (*Raimannia mollissima*), but the horizontal quadriseriate ovules, and the cylindric-ovoid capsule with compressed seeds clearly indicate it to be a true *Oenothera* (*Onagra*). He described the flowers as "coccinei," but it is uncertain whether this was from field-notes or from dried specimens. It should be remembered that the yellow colouring of the petals in these genera frequently changes to pink on drying.

Krause placed *Oe. serratifolia* and *Oe. scabra* in *Oenothera*, Spach (*Raimannia*). That they should be referred to *Oenothera*, Linn. (*Onagra*) is evident from the horizontal quadriseriate ovules, and the shape of the young capsules.

Among the aberrant species *Raimannia mexicana* appears to have drooping buds, judging from herbarium specimens, agreeing in this respect with *Anogra*, but it has the yellow flowers and biseriate ovules of *Raimannia*. On the other hand *Anogra coronopifolia* has the biseriate ovules characteristic of *Raimannia*, to which genus Rose referred it; but its nodding buds, purplish flowers and general habit point to a closer relationship with *Anogra*, in which it should be retained. It is evidently allied to *A. albicaulis*, Britton.

No great importance can be attached to the diurnal or nocturnal expansion of the flowers as a generic character. The flowers of *Raimannia* are generally described as nocturnal and those of *Anogra* as diurnal. But a *Raimannia* collected in Patagonia by Mr. J. L. Williams Andrews has diurnal flowers :

* Bull. Torr. Bot. Club, 1890, xvii. p. 213.
† Fedde, Repert. i. pp. 167–8 (1905).

" the blossom closes at evening and only reopens in the morning after the sun has commenced to shine "; and, according to Jepson* *Anogra californica* has vespertine flowers, remaining open two or three hours in the morning, or on a cloudy day until noon. Wooton and Standley describe the flowers of *Anogra* as nocturnal.†

Certain authors describe the seeds of *Raimannia* as being " crowned by a tubercle," but this appears to be a character confined to a few species.

The principal synonymy and a generic description of *Raimannia* are given below, followed by an enumeration of species referred to the genus by the writers. The list is not exhaustive, as it does not seem desirable to include certain little-known species of which no authenticated material has been available for examination.

Raimannia, *Rose* in Contrib. U.S. Nat. Herb. viii. p. 330 (1905); Britton et Brown, Ill. Fl. ed. 2, ii. p. 596 (1913). Wooton et Standley in Contrib. U.S. Nat. Herb. xix. p. 470 (1915). *Oenothera*, Spach, Hist. iv. p. 353 (1835); et in Ann. Sc. Nat. sér. 2, iv. p. 164 (1835); Raimann in Engl. et Prantl, Nat. Pflanzenf. iii. pt. 7, p. 214 (1893); Small in Bull. Torr. Bot. Club, 1896, xxiii. p. 172; Reiche, Fl. Chile, ii. p. 256 (1898); Small, Fl. S.E.U.S. ed. 2, p. 840 (1913).

Alabastra erecta, rarius nutantia. *Flores* tetrameri, nocturni, rarius diurni. *Hypanthium* elongatum, subcylindricum. *Sepala* reflexa, decidua. *Petala* lutea, exsiccando plus minusve rubescentia. *Stamina* 8, aequalia; antherae medifixae, versatiles, lineares; pollinis grana solitaria. *Ovarium* 4-loculare; ovula ascendentia, 2-seriata. *Capsula* linearis vel lineari-oblonga, quadrangularis, loculicide dehiscens, columna centrali. *Semina* numerosa, subteretia.—Herbae caulescentes, foliis alternis, floribus axillaribus vel spicatis.

Species 20–30, Americae borealis, Mexici et Americae australis incolae. Typus: *R. mollissima* (Linn.) Sprague et Riley.

Enumeratio Specierum.

R. Berteriana, *Sprague et Riley*, comb. nov.—*Oenothera Berteriana*, Spach.

R. colimae, *Rose.*

R. confusa, *Rose.*

R. coquimbensis, *Sprague et Riley*, comb. nov.—*Oenothera coquimbensis*, C. Gay.

R. Curtissii, *Rose.*

R. Drummondii (*Hook.*), *Rose.*

R. grandis (*Britton*), *Rose.*

R. heterophylla (*Spach*), *Rose.*

R. humifusa (*Nutt.*), *Rose.*

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* Fl. W. Mid. Calif. ed. 2, p. 282 (1911).

† Contrib. U.S. Nat. Herb. xix. p. 467 (1915).

R. indecora, *Sprague et Riley*, comb. nov.—*Oenothera indecora*, Camb.

R. laciniata (*Hill*), *Rose.*

R. littoralis (*Schlecht.*), *Rose.*

R. longiflora, *Sprague et Riley*, comb. nov.—*Oenothera longiflora*, Jacq.

R. macrosceles (*A. Gray*), *Rose.*

R. mendocinensis, *Sprague et Riley*, comb. nov.—*Oenothera mendocinensis*, Gill.

R. mexicana (*Spach*), *Woot. et Standley.*

R. mollissima, *Sprague et Riley*, comb. nov.—*Oenothera mollissima*, Linn.

R. nocturna, *Sprague et Riley*, comb. nov.—*Oenothera nocturna*, Jacq.

R. odorata, *Sprague et Riley*, comb. nov.—*Oenothera odorata*, Jacq.

R. Punae, *Sprague et Riley*, comb. nov.—*Oenothera Punae*, Kuntze. *Oe. Mandoni*, Léveillé. *Oe. Kuntziana*, Léveillé.

R. rhombipetala (*Nutt.*), *Rose.*

SPECIES EXCLUDENDA.

R. coronopifolia, Rose = **Anogra coronopifolia,** *Britton.*

XXIII.—THE GENUS THERORHODION.

J. HUTCHINSON.

For some time the writer has held the opinion that the curious and rare plant met with in a few of our gardens under the name *Rhododendron camtschaticum*,* Pall., would be better regarded as a separate genus from *Rhododendron* proper. This treatment has been accorded it by Mr. J. K. Small in the North American Flora, vol. 29, pt. i, p. 45 (1914), wherein Maximowicz's section *Therorhodion* is raised to generic rank. Mr. Small describes a new species, "*Therorhodion glandulosum*, Standley," from near Port Clarence, Alaska, distinguished from *T. camtschaticum* by its leaves being glandular-ciliate and its glabrous corolla with relatively longer lobes than tube. This species is not so far represented in our collections at Kew. To these two species should be added a third, *Therorhodion Redowskianum*, Hutchinson, a Manchurian plant described by Maximowicz as *Rhododendron Redowskianum*. This species has a curious botanical history. As far back as 1826, in the first volume of "Linnaea" (p. 513), it was identified by Chamisso and Schlechtendal with a European plant, *Rhodothamnus Chamae-*

* This is the original spelling; later authors have generally spelled it *kamtschaticum*.

cistus, Rchb. (*Rhododendron Chamaecistus*, L.), now known to be confined to the Eastern Alps (and Southern Translyvania ?), to which it bears a very close external resemblance. This erroneous determination was also recorded by H. E. M. James in the list of plants appended to his account of a journey in Manchuria entitled "The Long White Mountain," p. 458 (1888). James collected the plant between Mukden and Kirin.

Therorhodion camtschaticum occurs on both sides of the Behring Straits, *T. Redowskianum* in Eastern Manchuria (*see also* p. 205), and *T. glandulosum* in North West Alaska. The genus differs from *Rhododendron* proper by the flowers being borne on the young leafy shoots, and not in special buds as in the case of all true *Rhododendrons*, and in the unilaterally split corolla-tube. In the case of *Therorhodion Redowskianum* especially, and to a much less extent in that of *T. kamtschaticum*, the style (*see* Fig. 1) is very early abruptly reflexed from the base and projects through the sinus of the split corolla-tube, thus entirely removing its stigmatic surface from the stamens and effectively preventing self-fertilization. One might reasonably suppose that during the course of evolution of this interesting little genus the *bending* of the style, in order to avoid self-fertilization, has been a gradual process associated with the visits of insects, and has brought about a corresponding gradual splitting of the corolla-tube.

Below is given a key to the species of *Therorhodion* with a revised description of the two species represented at Kew.

Therorhodion, *Small* in North Amer. Fl. xxix. pt. i. 45 (1914). *Rhododendron* § *Therorhodion*, Maxim. in Mem. Acad. St. Petèrsb. ser. vii. xvi. n. 9, p. 47 (1870).

Leaves not glandular-ciliate; corolla pubescent outside, the lobes much longer than the tube; calyx-lobes veiny; style nearly as long as the corolla, not reflexed ... 1. *camtschaticum*.

Leaves glandular-ciliate; corolla glabrous outside, the lobes longer than the tube 2. *glandulosum*.

Leaves glandular-ciliate; corolla glabrous outside, the lobes about as long or a little shorter than the tube; style much shorter than the corolla, abruptly reflexed and protruding through the sinus of the split corolla ... ... 3. *Redowskianum*.

1. **Therorhodion camtschaticum,** *Small*, l.c. (1914).

Rhododendron camtschaticum, Pallas, Fl. Ross. i. 48, t. 33 (1784); Hook. Fl. Bor. Am. ii. 43 (1834); Maxim. l.c. 47 (1870); Hutchinson in Bot. Mag. t. 8210 (1908). *Rhodothamnus kamtschaticus*, Lindl. in Paxt. Fl. Gard. i. t. 22 (1850). *Chamaerhododendros Berberis folio*, etc., Gmel. Fl. Sibir. iv. 126 (1769). *Rhododendron Chamaecistus*, Linnaeus, Mant. 381 (1771), quoad syn. Gmel., non pl. europ.

A low undershrub up to about 20 cm. high, usually about 12 cm.; stems curved, ascending or subdecumbent, often tinged with purple, rough with persistent leaf-bases, at first clothed with long slender subsetose hairs which are sometimes gland-tipped. *Leaves* deciduous, becoming larger in the upper part of the branch, in the lower part gradually metamorphosed into bud scales, sessile, obovate or spathulate-obovate, slightly decurrent at the base, rounded to an obtuse glandular apex, 2–5 cm. long, 1–2·5 cm. broad, chartaceous, strongly nerved and veined especially below, the nerves ascending and looped towards the apex, often setose below. *Flowers* solitary, terminating each branchlet; pedicels bearing large leafy bracts and numerous setose gland-tipped hairs, the uppermost bracts scarcely different from the calyx segments. *Calyx* lobed almost to the base, densely setose-pubescent outside; segments foliaceous, green, oblong, with an obtuse glandular apex, 1–1·8 cm. long, 4–5 mm. broad, strongly nerved, setose outside and on the margin. *Corolla* about 2·5 cm. long, carmine-purple; tube split to the base or nearly so on one side, about $\frac{1}{3}$ as long as the lobes, pubescent outside; lobes oblong-elliptic, rounded at the apex, pubescent outside, spotted within. *Stamens* 10, declinate, the longest as long as the corolla; filaments very unequal, densely pubescent towards the base, purple-red; anthers nearly black, very broad. *Ovary* 5-celled, broadly ovoid, pubescent; style nearly as long as the corolla, curved, purple-red, villous-pilose towards the base; stigma depressed-capitate, slightly 5-lobed. *Capsule* narrowly oblong-ellipsoid, 5-lobed, scarcely 1 cm. long, shortly pubescent. *Seeds* very small, scarcely 0·5 mm. long, oblong-elliptic, flat.

Distribution.—In muddy mountainous places on both sides of Bering Straits and on the shores of the sea of Okhotsk, including Sakhalin, Kurile Islands, northern Japan (Yezo N.E. Hondo); in Alaska as far south as Bank's Island.

In its native habitat this charming little plant blossoms from the end of July and ripens its seeds about the end of September. In the British Islands, therefore, it should be grown in as cold a situation as possible, preferably under a north wall. Otherwise it is apt to premature growth, and is liable to be damaged by late spring frosts.

2. **Therorhodion glandulosum,** *Standley ex Small*, l.c. (1914).

" A low shrub forming dense clumps about 1 dm. tall, usually copiously branched; leaf-blades spathulate, often broadly so. or oval or ovate, on the upper part of the branches, 1–2 cm. long or less, obtuse, often rounded and abruptly pointed, or sometimes acute at the apex, crenulate, glandular-ciliate, veiny, somewhat shining, sessile or nearly so; calyx-lobes oblong, often narrowly so, to elliptic-oblong, 8–10 mm. long in anthesis, glandular-pubescent and glandular-ciliate; corolla rose-purple, 2 cm. long or slightly shorter, glabrous, the lobes somewhat erose,

eciliolate; capsules oval, 7–9 mm. long, pubescent with short white hairs."

DISTRIBUTION.—Foot of Kigluaik Mountains, near Oogluk Bay, Imuruk Basin, Alaska (type in U.S. Nat. Herb.).

3. **Therorhodion Redowskianum,** *Hutchinson*, comb. nov.
Rhododendron Redowskianum, Maxim. Prim. Fl. Amur. 189 (1859) et l.c. 48, t. ii. Fig. 21–25 (1870); Komarov, Fl. Manshur. iii. 208 (1907). *Rhododendron Chamaecistus*, Cham. et Schlt. in Linnaea, i. 513 (1826); James, "The long White Mountain," 458 (1888); non Linn.

FIG. 1.
Therorhodion Redowskianum, Hutchinson
(nat. size, floral parts enlarged).

A low shrublet about 10 cm. high, branched from the base; older branches covered with smooth light grey bark, rough

with the persistent bases of the leaves; young branches very short, leafy, thinly setose with gland-tipped hairs. *Leaves* deciduous, crowded, spathulate-oblanceolate attenuated to the subdecurrent base, with a thick obtuse gland at the subtriangular apex, 0·5–1·5 cm. long, 3–6 mm. broad, chartaceous, with conspicuous nerves on the lower surface, prominently ciliate with gland-tipped hairs. *Flowers* solitary or up to three on each young shoot; pedicel with several small leafy bracts, finely puberulous and with a few scattered gland-tipped hairs. *Calyx* 5-lobed to the base; segments linear-oblong, obtuse, about 5 mm. long and 1·75 mm. broad, finely puberulous outside, ciliate with gland-tipped hairs. *Corolla* about 1·5 cm. long, split to the base on one side, glabrous; tube 7–8 mm. long; lobes broadly oblong, crenulate, 6 mm. long, 5 mm. broad. *Stamens* 10, a little longer than the tube; filaments pubescent in the lower third; anthers broad, about 1·5 mm. long. *Ovary* densely pubescent; style abruptly reflexed through the sinus of the corolla, 5 mm. long, pubescent in the lower half; stigma discoid, lobulate. *Fruits* not seen.

Distribution.—Manchuria and according to Komarov, l.c., through Kamtschatka into Alaska. The plant from the latter place, however, may be that described by Small as *T. glandulosum*. I have seen only the specimen collected by James in Manchuria.

XXIV.—A REVISION OF THE GENUS CAPRARIA.

T. A. Sprague.

The genus *Capraria* (*Scrophulariaceae-Digitaleae*) comprises five species endemic in tropical and subtropical America. All are undershrubs with alternate more or less serrate leaves, regular or somewhat bilabiate corolla and five or four stamens. The capsule is septicidal with a large central column, and each valve splits more than half way down the dorsal suture. The commonest species, *C. biflora*, Linn., has become naturalized in the Cape Verde Islands, the Gold Coast and Mauritius, but unlike many tropical American weeds has not yet reached Indo-Malaya or Polynesia.

The closest relationship of *Capraria* is with *Scoparia*; both genera possess pellucid-dotted leaves, the dots being due to the presence of external peltate glands which are imbedded in small depressions in the surface of the leaf. In Bentham and Hooker's Genera Plantarum *Scoparia* and *Capraria* are placed side by side, but in Wettstein's arrangement in Engler u. Prantl, Nat. Pflanzenfam., the Asiatic genus *Hemiphragma*, which has relatively little in common with either, is intercalated between them. This is due to his adoption of an analytical classification, in which the alternate-leaved genera precede the opposite-leaved ones.

The history of *Capraria* commences in 1689, when *C. biflora* was mentioned by Paul Herman* and Jacob Breyne† as a rare plant cultivated in botanic gardens in Holland. Herman gave it the name *Capraria Curassavica*, the generic name indicating that the plant was eaten by goats, and the trivial that it was a native of the island of Curaçao. Breyne called it *Gratiolae affinis frutescens Americana, foliis Agerati, seu Veronicae erectae majoris.*

Commelin‡ published a description and coloured figure of the plant in 1697, and mentioned that in 1690 a box of the dried leaves prepared in the manner of tea came into his hands. This had been taken from a French prize brought from the West Indies. Characteristic woodcuts were given by Plukenet in 1691,§ and Herman in 1698;‖ the former proposed the specific phrase *Lysimachiae purpureae affinis Americana procumbens, Anonidis Vernae frutescentis, folio singulare glabro.*

The species was known in Curaçao as Cabritten-Kruid, Cabritien-Kruidt, Cabritta and Cavritta, the last being the Portuguese form of the name.

The fact that *C. biflora* yielded a kind of tea was known in Jamaica at least as early as 1680. Barham, writing in 1711, stated that "the virtue of this herb . . . hath been known with us above thirty years."¶ It cannot, however, have been in general use, judging from Sloane's remark in 1707: "Why some give it the name of Thea, I cannot imagine."**

Labat,†† who visited Guadeloupe and Martinique in 1696 found "wild tea" growing in abundance, and gave a long account of the plant, its preparation and use; his description leaves no doubt that it was *Capraria biflora*. He thought that it was identical with China tea, a belief which survived in the West Indies to the middle of the eighteenth century, when N. J. Jacquin stated that he could hardly convince the colonists to the contrary.‡‡

A second species was described by Feuillée in 1714 under the name *Capraria peruviana, Agerati foliis absque pediculis.* This grew on islands of the river Rimac at Lima, Peru. Feuillée stated that it first became known in Peru in 1709, and that it possessed the same properties as East Indian tea, so that the Peruvians soon abandoned the use of the latter.§§

Linnaeus adopted the generic name *Capraria*, and at first regarded the Peruvian species as being the same as the West

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* Herman, Parad. Bat. Prodr. p. 319 (1689).
† Breyne, Prodr. ii. p. 54 (1689).
‡ Commelin, Hort. i. p. 79, t. 40 (1697).
§ Plukenet, Phytogr. t. 98 f. 4 (1691); Alm. p. 237 (1696).
‖ Herman, Parad. Bat. p. 110, t. 110 (1698).
¶ Barham, Hortus Americanus, p. 187 (1794); Dict. Nat. Biogr. iii. p. 187.
** Sloane, Nat. Hist. Jamaica i. p. 210 (1707).
†† Labat, Voy. i. part 2, p. 340 (1724).
‡‡ N. J. Jacquin, Hist. p. 182 (1763).
§§ Feuillée, Obs. ii. p. 764, t. 48 (1714).

Indian,* but was afterwards inclined to separate them.† In 1737 he recognised two species of *Capraria*, the first being based on *Capraria Curassavica*, Herm., and the second founded on *Veronica Americana erecta frutescens*, Herm. Parad. p. 241, t. 241; but in 1748 he made the latter the type of a new genus *Scoparia*.‡

Little need be said of the history of *Capraria* since 1753. Ruiz and Pavon re-described *C. peruviana*, and made it the type of a new genus *Xuarezia* on account of its flowers being pentandrous;§ and the same character led W. J. Hooker to describe it as a new species of *Witheringia* (*Solanaceae*).‖

A third species was described by Miller in 1768 from Vera Cruz, Mexico, as *Erinus frutescens*,¶ was re-named *Capraria cuneata* by Robert Brown,** and re-described as *C. saxifragaefolia* by Chamisso and Schlechtendal in 1830.†† On the last was based the genus *Pogostoma*, Schrad.,‡‡ now regarded as a synonym of *Capraria*.

The fourth species, *C. integrifolia*, Mart. et Gal.,§§ was not published until 1845. It was collected by Galeotti on the Cordillera of Oaxaca, and does not appear to have been re-discovered. The leaves are described as entire, and the corolla as hardly longer than the calyx.

Bentham described a fifth species, *C. mexicana*, Moric., in 1846.‖‖ This has lanceolate acute corolla-lobes, twice as long as the tube.

Capraria lanceolata, Vahl (1789) and *C. hirsuta*, H.B.K. (1817), appear to be mere forms of *C. biflora*, which is very variable, according to Pennell.¶¶

There remain nearly thirty names under *Capraria* which are referable to other genera and families. These will be found in the list of excluded species at the end of the article.

Capraria, [*Herm.* Parad. Bat. Prodr. p. 319 (1689); Parad. Bat. p. 110 (1698); Feuillée, Obs. ii. p. 764 (1714); Linn. Hort. Cliff. p. 320 (1737), partim] *Linn.* Sp. Pl. ed. 1, p. 628 (1753); Gen. Pl. ed. 5, p. 276 (1754); Benth. in DC. Prodr. x. p. 429 (1846); Benth. et Hook. f. Gen. Pl. ii. p. 959 (1876).

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* Linn. Hort. Cliff. p. 320 (1737).

† Linn. Sp. Pl. ed. 1, p. 628 (1753).

‡ Linn. Syst. Nat. ed. 6, p. 87 (1748); Sp. Pl. ed. 1, p. 116; Gen. Pl. ed. 5, p. 52.

§ Ruiz et Pav. Fl. Peruv. ii. p. 13, t. 123, fig. a (1799).

‖ Hook. Bot. Misc. ii. p. 231 (1831).

¶ Mill. Gard. Dict. ed. 8, No. 4 (1768).

** Ait. Hort. Kew. ed. 2, iv. p. 45 (1812).

†† Cham. et Schlecht. in Linnaea, v. p. 105 (1830).

‡‡ Schrad. Ind. Sem. Hort. Gott. 1831; Linnaea, viii. Litt. p. 34 (1833).

§§ Mart. et Gal. in Bull. Acad. Brux. xii. pars 2, p. 20 (1845); Walp. Rep. vi. p. 645.

‖‖ Benth. in DC. Prodr. x. p. 429 (1846).

¶¶ Pennell in Proc. Acad. Nat. Sc. Philad. 1920, p. 147.

Xuarezia, Ruiz et Pav. Syst. Veg. p. 46 (1798); Fl. Peruv. ii. p. 13, t. 123, fig. a (1799).

Pogostoma, Schrad. Ind. Sem. Hort. Gott. 1831; Linnaea, viii. Litt. p. 34 (1833); Benth. in DC. Prodr. x. p. 430 (1846).

KEY TO THE SPECIES.

Corolla hardly exceeding the sepals; leaves entire - - - - - - - - 4. *integrifolia.*
Corolla considerably longer than the sepals;
  Corolla-lobes much shorter than the tube; pedicels and calyx densely glandular-pilose; stamens subdidynamous - 5. *frutescens.*
  Corolla-lobes equalling or longer than the tube:
    Corolla subrotate; calyx-lobes half as long as the capsule - - - 1. *peruviana.*
    Corolla not subrotate; calyx-lobes usually as long as or longer than the capsule:
      Corolla-lobes lanceolate, acute, twice as long as the tube - - - 2. *mexicana.*
      Corolla-lobes oblong, obtuse, as long as or rather longer than the tube - 3. *biflora.*

1. **C. peruviana,** *Benth.* in DC. Prodr. x. p. 430 (1846); Robinson in Proc. Am. Acad. xxxviii. p. 202 (1902); A. Stewart in Proc. Calif. Acad. Sc. i. p. 141 (1911).

Xuaresia biflora, Ruiz et Pav. Syst. Veg. p. 46 (1798); Fl. Peruv. ii. p. 13, t. 123, fig. a (1799).

Witheringia salicifolia, Hook. Bot. Misc. ii. p. 231 (1831).

Capraria peruviana, Agerati foliis absque pediculis, Feuillée, Obs. ii. p. 764, t. 48 (1714).

VERNACULAR NAMES.—Té del Peru. Té de Lima.

GALAPAGOS ISLANDS.—Charles Island, *Markham*, *Stewart* 3430 (Mus. Brit.).

PANAMA.—On old walls, Panamá, *Sutton Hayes* 395.

COLOMBIA.—Without locality, *Lobb*.

ECUADOR.—Guayaquil, common in savannahs by the river Daule, *Spruce* 6301.

PERU.—Village of Quiros, *Seemann* 939. Lurin, Lima *Cruckshanks* (type of *Witheringia salicifolia*). In wet places by the river Rimac, Lima, *Nation*. Valley of Santa Clara, *Barclay* (Mus. Brit.).

According to Feuillée (l.c.), the leaves of *C. peruviana* were used as tea in Peru in the eighteenth century.

C. peruviana may be distinguished from *C. biflora*, to which it is reduced in the Index Kewensis, by the regular subrotate corolla, five stamens, and sepals only half as long as the capsule. Hemsley* apparently regarded *C. peruviana* as conspecific with

* Biol. Centr.-Amer. Bot. ii. p. 455 (1882).

C. biflora, although he did not quote it as a synonym : he stated, however, that *C. biflora* extended to Peru, and identified a Panamá specimen of *C. peruviana* as *C. biflora* (in Herb. Kew).

C. peruviana has not been recorded from Colombia previously. Pennell does not include it in his enumeration of Colombian Scrophulariaceae.*

2. **C. mexicana,** *Moric. ex Benth.* in DC. Prodr. x. p. 429 (1846); Greenman in Proc. Am. Acad. xl. p. 31 (1904).

C. biflora, Hemsl. Biol. Centr.-Amer., Bot., partim, non Linn.

Mexico.—Tampico, *Berlandier*, sine numero (type), *Berlandier* 10 (Mus. Brit.), *Palmer* 188 (Mus. Brit.). Between San Luis Potosi and Tampico, *Palmer* 1125. Tamaulipas, Soto la Marina, *Nelson* 6643 (fide *Greenman*). Vera Cruz, near Tantoyuca, *Ervendberg* 184 (fide *Greenman*).

3. **C. biflora,** *Linn.* Sp. Pl. p. 875 (1753); Jacq Hist. p. 182, t. 115 (1763); Lam. Encycl. i. p. 604 (1783); Ill. t. 534, fig. 2; H.B.K. Nov. Gen. Sp. ii. p. 354 (1817); Descourtilz, Fl. Antill. iv. p. 313, t. 300 (1827); Griseb. Fl. Brit. W. Ind. p. 427 (1861); J. A. Schmidt in Mart. Fl. Bras. viii, pars 1, p. 293 (1862); Grosourdy, Med. Bot. Crioll. iii. p. 167 (1864); Ernst in Journ. Bot. 1865, p. 284; Millsp. in Publ. Field Columb. Mus., Bot. i. p. 45 (1895); l.c. 319 (1896); l.c. ii. 98 (1900); l.c. 236 (1907); Loes. in Engl. Jahrb. xxiii. p. 120 (1896); Combs in Trans. Acad. Sc. St Louis, vii. p. 449 (1897); Duss in Ann. Mus. Col. Marseille, iii. p. 403 (1897); Robins. in Proc. Am. Acad. xxxviii. p. 202 (1902); Donn. Smith in Pittier, Primit. Fl. Costaric. ii. p. 179 (1898); Loes. in Bull. Herb. Boiss. sér. 2, iii. p. 284 (1903); Pulle, Enum. Pl. Surinam, p. 416 (1906); J. R. Johnston in Proc. Bost. Soc. Hist. Nat. xxxiv. pp. 258, 276 (1909); Urb. Symb. Antill. iv. p. 560 (1911); Glaziou in Bull. Soc. Bot. France. Mém. 3, p. 509 (1911); Boldingh Fl. Ned. W. Ind. p. 361 (1913); Small, Fl. S.E.U.S., ed. 2, p. 1069 (1913); Britton, Fl. Bermuda, p. 348 (1918); Britton and Millsp. Bahama Fl. p. 391 (1920).

C. lanceolata, Vahl, Ecl. ii. p. 47 (1798).

C. semiserrata, Willd. Sp. Pl. iii. p. 324 (1800).

C. semiserrata, var *Berterii*, A. DC. in DC. Prodr. x. p. 429 (1846); Millsp. in Publ. Field Columb. Mus., Bot. ii. p. 98 (1900).

C. hirsuta, H.B.K. Nov. Gen. Sp. ii. p. 355 (1817), teste Benth. in DC. Prodr. x. p. 429.

C. mexicana, Griseb. Fl. Brit. W. Ind. p. 427 (1861), non Moric.

Capraria Curassavica, Cabiritta vulgo, Herm. Parad. Bat. Prodr. p. 319 (1689).

Capraria Corassavica, Cavritta Lusit., Herm. Parad. Bat. p. 110, t. 110 (1698).

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* Proc. Acad. Nat. Sc. Philad. 1920, p. 147.

Gratiolae affinis frutescens americana, foliis Agerati, seu Veronicae erectae majoris, Breyn. Prodr. ii. p. 54 (1689); ed. 2. p. 69 (1739); Commelin, Hort. i. p. 79, t. 40 (1697); Sloane Nat. Hist. Jamaica, i. p. 209 (1707), et l.c. ii. p. 373 (1725).

Lysimachiae purpureae affinis Americana procumbens, Anonidis Vernae frutescentis, folio singulari glabro, Pluk. Phytogr. t. 98, fig. 4 (1691); Pluk. Alm. p. 237 (1696).

Thé sauvage, Labat, Voy. i. part 2, p. 340 (1724).

Capraria foliis alternis, corollis quinquefidis, Linn. Hort. Cliff. p. 320 (1737), quoad plantam curassavicam.

Vernacular Names.—Stow-weed (Bahamas); Goat-weed (West Indies); Wild Tea (West Indies); Thé du pays, Thé muraille (Martinique, Guadeloupe); Thé de la Guadeloupe (French Guiana); Thé d'Amérique (Santo Domingo); Té del pais, Té de la tierra (Puerto Rico); Té Nacional (Colombia); Escabiosa (Cuba), Tantsji (Curacao, Aruba, Bonaire); Agrimonia silvestre, Claudiosa (Yucatan); Fregosa (Venezuela); Balsaminha (Brazil).

Tropical and Subtropical America.—Recorded from Bermuda (naturalized), Florida, Texas, Mexico, Central America, West Indies, Colombia, Venezuela, Guiana and Brazil. Apparently absent from the Pacific Coast of South America, where the genus is represented by *C. peruviana*. Naturalized in the Cape Verde Islands, the Gold Coast and Mauritius.

An infusion of the leaves of *C. biflora* has been used as tea and as a medicine in the West Indies, Colombia, Venezuela, Guiana and Brazil. When taken in moderation it acts as a gentle stimulant to the nervous system, and as a digestive tonic, but too strong doses produce general debility, loss of memory, and even paralysis.*

It is cultivated under the name Té Nacional in the Department of Boyacá, Colombia by Senor Juan T. Torero, from whom a sample of "tea" and a set of herbarium specimens have been received at Kew, through the instrumentality of Mr. T. M. Dawe. The seeds take from three to six months to germinate, according to Señor Torero.

4. **C. integrifolia,** *Mart. et Gal.* in Bull. Acad. Brux. xii. pars 2, p. 20 (1845); Walp. Rep. vi. p. 645; Hemsl. Biol. Centr.-Amer., Bot. ii. p. 455 (1882).

Mexico.—Cordillera of Oaxaca, Juquila del Sur, on gneiss rocks, 1500 m., *Galeotti* 653 (testibus *Mart. et Gal.*).

5. **C. frutescens,** *Britten* in Journ. Bot. 1907, p. 315.

Erinus frutescens, Mill. Gard. Dict. ed. 8, No. 4 (1768).

Capraria cuneata, R. Br. in Ait. Hort. Kew. ed. 2, iv. p. 45 (1812).

C. saxifragaefolia, Cham. et Schlecht. in Linnaea, v. p. 105 (1830); Loes. in Bull. Herb. Boiss. 1894, ii. p. 562; Hemsl. Biol. Centr.-Amer. Bot. ii. p. 455 (1882); Millsp. in Publ. Field Columb. Mus., Bot. i. p. 319 (1896).

* Grosourdy, Med. Bot. Crioll. iii. p. 167 (1864).

Pogostoma saxifragaefolia, Schrad. Ind. Sem. Hort. Gott. 1831; Linnaea, viii. Litt. p. 34 (1833); Benth. in DC. Prodr. x. p. 430 (1846).

Vernacular Name.—Claudiosa (Yucatan).

Mexico.—Vera Cruz, *Houston* (type). *Schiede*. Vera Cruz, near Panuco, *Seler* (teste *Loesener*). Shores of Lake Tamiahua, *Berlandier* 157 (Mus. Brit.). San Luis Potosi to Tampico, *Palmer* 1128. San Luis Potosi, near Tancanhuitz, *Seler* (teste *Loesener*). Near the Pacific, *Beechey*. Manzanillo, *Palmer* 917. Acapulco, *Barclay* 1964 (Mus. Brit.), *Palmer*, 567. Yucatan, Izamal, abundant in open places, *Gaumer* 520 (teste *Millspaugh*). Nojcacal, *Schott* 717 (= 70) (Mus. Brit.).

Excluded Species.

C. aegyptiaca, Steud. et Hochst. ex Endl. Gen. p. 682 (1839); Steud. Nomencl. ed. 2, i. p. 278 (1840) = **Anticharis arabica,** *Endl.*

C. annua, Kuntze, Rev. Gen. pars 2, p. 459 (1891) = **Scoparia annua,** *Cham. et Schlecht.*

C. arabica, Steud. et Hochst. ex Endl. Iconogr. Gen. Pl. p. xii. (1839); Nov. Stirp. Dec. p. 23 (1839) = **Anticharis arabica,** *Endl.*

C. calycina, A. Gray in Proc. Am. Acad. vi. p. 49 (1862) = **Myoporum debile,** *R. Br.*

C. crustacea, Linn. Mant. p. 87 (1767) = **Vandellia crustacea,** *Benth.*

C. diffusa, Roxb. Hort. Beng. p. 47 (1814); Fl. Ind. iii. p. 93 (1832) = **Ebermaiera thyrsoidea,** *Wall.*

C. dissecta, Delile, Fl. Égypte, p. 95, t. 32, fig. 3 (1812) = **Sutera glandulosa,** *Roth.*

C. dulcis, Kuntze, Rev. Gen. pars 2, p. 459 (1891) = **Scoparia dulcis,** *Linn.*

C. durantifolia, Linn. Syst. ed. 10, p. 1116 (1759) = **Stemodia durantifolia,** *Sw.*

C. elliptica, Kuntze, Rev. Gen. pars 2, p. 459 (1891) = **Scoparia elliptica,** *Cham.*

C. ericacea, Kuntze, l.c. = **Scoparia ericacea,** *Cham. et Schlecht.*

C. gratioloides, Linn. Syst. ed. 10, p. 1117 (1759) = **Ilysanthes dubia,** *Barnh.—I. gratioloides*, Benth.

C. gratissima, Roxb. Hort. Beng. p. 47 (1814); Fl. Ind. iii. p. 92 (1832) = **Limnophila Roxburghii,** *G. Don.*

C. humifusa, Buch.-Ham. ex Wall. Cat. n. 3883 (1831) = **Centranthera humifusa,** *Wall.*

C. humilis, Ait. Hort. Kew. ed. 1, ii. p. 354 (1789) = **Stemodia verticillata,** *Sprague*, comb. nov.—*Erinus verticillatus*, Mill. (1768). *Stemodia parviflora*, Ait. (1812). *S. arenaria*, H. B. K. (1817). *Conobea pumila*, Spreng. (1819).

C. integerrima, Miq. in Linnaea, xxii. p. 476 (1849) = **Sesamum indicum**, *Linn.* (*vide* Pulle, Enum. Pl. Surinam, p. 430).

C. lanceolata, Linn. f. Suppl. p. 284 (1781) = **Freylinia lanceolata**, *G. Don.*

C. longiflora, Thunb. Mus. Upsal. xvii. p. 150 (1794), nomen = **Freylinia undulata**, *Benth.* (*vide* Juel, Plantae Thunbergianae, p. 422).

C. lucida, Ait. Hort. Kew, ed. 1, ii. p. 353 (1789) = **Teedia lucida**, *Rudolphi.*

C. Monnieria, Roxb. Hort. Beng. p. 47 (1814) = **Herpestis Monnieria**, H. B. K. .

C. montevidensis, Kuntze, Rev. Gen. pars 2, p. 459 (1891) = **Scoparia montevidensis**, *R. E. Fries.*—*S. flava*, Cham. et Schlecht.

C. multifida, Michx. Fl. Bor. Am. ii. p. 22, t. 35 (1803) = **Conobea multifida**, *Benth.*

C. multiflora, Steud. Nomencl. ed. 1, p. 149, sphalm. = **Conobea multifida**, *Benth.*

C. pusilla, Torr. in Ann. Lyc. N. York, i. p. 36 (1824) = **Mimulus floribundus**, *Dougl.*

C. rigida, Buch.-Ham. ex Hook. f. Fl. Brit. Ind. iv. p. 301 (1884) = **Centranthera hispida**, *R. Br.*

C. rigida, Thunb. Prodr. p. 103 (1800) = **Ehretia rigida**, *Druce.*—*Freylinia rigida*, G. Don. *Ehretia hottentotica*, Burch. (*vide* Dyer, Fl. Cap. iv. sect. 2, p. 5).

C. salicifolia, Salisb. Prodr. p. 94 (1796) = **Freylinia lanceolata**, *G. Don.*

C. undulata, Linn. f. Suppl. p. 284 (1781) = **Freylinia undulata**, *Benth.*

C. uniflora, Burm. f. Fl. Ind. p. 133, t. 14, fig. 3 (1768 = **Lysimachia sp.** (ex icone).

XXV.—MISTLETOE ON LIME-TREES.

L. A. Boodle.

The Common Mistletoe (*Viscum album*, L.) has been found by Tubeuf* to include three biologic (or physiological) races, two occurring on Conifers, and one on various Dicotyledons. The Dicotyledonous hosts are numerous, a list of 37 species being given for Switzerland by Coaz† in a paper on the distribution of the Mistletoe in that country. In this list, Apple, wild and cultivated, stands first as being most strongly attacked, Lime-trees being placed next in order, and then Poplars.

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* Tubeuf, Die Varietäten oder Rassen der Mistel, Naturwiss. Zeitschr. für Land- und Forstwirtschaft, vol. 5 (1907), p. 321; *see also* vol. 8 (1910), p. 12; Sorauer, Handb. der Pflanzenkrankheiten, ed. 3, vol. 2, p. 492; Heinricher, Aufzucht d. Parasit. Samenpflanzen, 1910, p. 43.

† Coaz, Naturwiss. Zeitschr. f. Land- und Forstwirtschaft, vol. 16 (1918), p. 183.

In England, also, Lime is among the more frequent hosts of the Mistletoe, and the presence of the parasite on Lime is sometimes associated with the occurrence of large swellings on some of the branches attacked. The following is a statement made by Elwes and Henry* on this subject :—" In some parts of England especially in Essex and Herts. the Lime is infested by Mistletoe, which often kills the branches and causes irregular excrescences, which sometimes have an elongated gourd-like shape."

Mistletoe is abundant on Lime-trees in the grounds of Hampton Court Palace, and the branches of these trees show swellings of various sizes, sometimes resembling a gourd in shape. The presence of the mistletoe and of the swellings on the Lime-trees at Hampton Court was noted by " A. D. " in the *Gardeners' Chronicle* in 1907.† Mr. W. Dallimore recently examined these trees, and observed that, though mistletoe appeared to be present on all the swellings, there was usually a difference between those of large and those of small size, mistletoe being conspicuous on the smaller swellings, but often hardly visible on the larger ones, when viewed at a little distance.

A similar difference was shown by four specimens cut from these trees and sent to Kew for examination. One of these has a large swelling, the swollen portion being about eight inches in diameter, while the three other specimens are considerably smaller. In the case of the three smaller specimens, there is a fairly well developed growth of leafy stems of mistletoe (4 to 14 inches high), on the enlarged part of the Lime-branch, while on the large specimen only diminutive sprouts and the broken stumps of some small stems of mistletoe are to be found. An example similar to the last is presented by a specimen, in Museum IV. at Kew, of a large swelling on a branch of Lime from Windsor. In this case also, mistletoe is present, but very inconspicuous, close inspection being required to find a certain number of small shoots, and bases of others that have been broken off.

In the four specimens from Hampton Court, mistletoe is present in the swollen regions, that is to say, besides the aerial stems and leaves of the parasite, there are :—(1) a number of the so-called cortical roots, running for the most part longitudinally in the Lime-branch just outside the cambium of the latter; and (2) numerous peg-like outgrowths from the inner face of the cortical roots, called " sinkers," " borers " or " haustoria." These project radially for some distance into the wood, and thus cause interruptions in the cambial layer of the host-plant. In the specimen of a large swelling from Hampton Court numerous dead sinkers were found in the wood. To judge from

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* Elwes and Henry, Trees of Great Britain and Ireland, vol. 7, p. 1672.

† Gard. Chron., ser. 3, vol. 41, p. 240.

the abundance and character of these, it appears probable that this enlarged portion of the branch bore well-developed plants of mistletoe some years ago. Moreover it was seen, on stripping off the bark, that fairly numerous roots and sinkers of mistletoe, in a living condition, were present in this specimen, although there was such a poor external growth of the parasite.

The conclusion derived from an examination of the specimens from Hampton Court is that, in these, enlargement of the branch is due to the presence of mistletoe. Further, the general supposition may be made that, where large swellings on branches of Lime bear mistletoe of meagre growth, vigorous plants of the parasite were present during the earlier stages of the enlargement, but that they may have since disappeared, perhaps having been torn off by the wind, after they had caused some cankering of the branch, and thereby loosened their hold. Though living roots, sinkers and buds of the parasite may be present in large swellings on the Lime, there would appear to be some condition usually inhibiting any strong aerial growth of mistletoe. Possibly the thickness of the bark or the nature of the cork-layers of the Lime at this stage of the enlargement may be unfavourable to the development of the aerial stems of the mistletoe.

In some parts of the specimens examined, the influence of the parasite in causing enlargement is clearly indicated. For instance, local enlargements were seen following the course of some roots and sinkers, which extended beyond the general limit of the swelling. Enlargement depends on increased breadth of the annual rings of the wood, and, to a small extent, on thickening of the bark. The influence of sinkers in inducing the formation of enlarged annual rings in the wood of the host was noted by Pitra,* and earlier by Schacht (quoted by Pitra). Pitra suggested by way of explanation that the streaming of sap towards the roots and sinkers of the mistletoe, due to the osmotic power of the latter, might cause an increased supply of nutritive material to be available for the adjacent cambial layer of the host.

Some such cause may favour the rapid growth of wood in the neighbourhood of sinkers and roots during the earlier stages in the formation of the swelling, but there is another factor which perhaps may become important in the later stages. Owing to the disturbance of the cambial growth by sinkers and by the healing of canker-spots (opposite dead sinkers, etc.), the later formed wood and bast attain the type of structure found in burrs,† the grain running in various directions at different points. The presumable effect of this confused and often intricate course of the conducting elements would be a slow longitudinal transference of sap, and consequent congestion of food materials, in the swollen region, locally increased cambial growth being

* Pitra, Bot. Zeitung, vol. 19 (1861), p. 64.

† This was clearly seen in the large specimen from Hampton Court.

thus favoured. One may suppose, to express the matter differently, that the burr- or bird's-eye-type of structure, while making longitudinal conduction more difficult, will scarcely reduce facilities for conduction in a radial direction, *i.e.*, towards the cambium. Hence one may regard the supply of nutriment to this tissue as being rendered *relatively* somewhat easier than in normal wood and bast. A similar suggestion may be made with regard to ordinary burrs on the stems of various trees, namely, that one of the factors concerned in the progressive enlargement of the burr may be the special structure of the wood and bast* as affecting conduction. Other factors may be more directly connected with the presence of numerous arrested adventitious buds or roots.

The four specimens from Hampton Court show some diseased wood continuous with the remains of dead branches, decay having gone so far in the large specimen that a central cavity (inhabited by wood-lice) extended through part of the swelling. A little diseased wood also immediately surrounds many of the dead sinkers individually, or forms a confluent patch where they are crowded. The occurrence of diseased wood, other than that in the mistletoe-cankers, appears to have played no part in the origin of the swellings, but, when an enlargement has been formed, decay of a considerable tract of the inner wood might favour more rapid enlargement by causing the flow of sap to be confined to the outer wood, *i.e.*, the region of the wood showing more or less burr-like structure owing to the action of the mistletoe. Possibly most of the large swellings on the Lime may have a hollow centre, but data are not available on this point.

Elwes†, when referring to the occurrence of burr-like swellings and of mistletoe on branches of Lime-trees in Essex, stated that "no mistletoe was now present on many of the branches so malformed," but expressed the opinion that the occurrence of the swellings "might be wholly or partially due to the arrested growth of the branch where the mistletoe had taken root on it." Possibly the branches described as bearing no mistletoe may have been viewed at a little distance, in which case diminutive sprouts of mistletoe might have been overlooked. Perhaps, on the other hand, the aerial shoots of the parasite may completely disappear in some cases.

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* Enlarged medullary rays form a frequent character of these burrs as well as the contorted grain.

† Elwes, Gard. Chron., ser. 3, vol. 41 (1907), p. 224.

XXVI.—DECADES KEWENSES.

PLANTARUM NOVARUM IN HERBARIO HORTI REGII CONSERVATARUM.

DECAS CIII.

1021. **Biophytum insigne,** *Gamble* [Geraniaceae-Oxalideae]; species inter omnes alias regionis indicae orientalis adhuc cognitas foliolis magnis nervis subregularibus in marginem incrassatum desinentibus insignis.

Suffrutex humilis, caule erecto rugoso fere nigro, aliquando apicem versus in 2–4 ramulos diviso. *Folia* ad apicem caulis conferta, stipulis multis lineari-laceolatis strigoso-hirsutis munita, paripinnata, circiter 10 cm. longa, rhachi communi basi 2–4 cm. longa nuda parce villosa supra canaliculata; foliolorum paria 7–10, inferiora minora, ovata, media longiora, ultima 1 vel 2 oblonga, basi inaequalia, subcordata, ad 3·5 cm. longa, 1–1·5 cm. lata, mucronata, subtus parce villosa, costa media nervis primariis rectis circiter 10–12 in marginem incrassatum desinentibus, secundariis 1–2 vel pluribus additis. *Scapi* 2 vel plures inter folia orti, graciles, ad 3 dm. longi, umbellis terminalibus 8–12-floris, bracteis parvis multis lanceolatis villosis; pedicelli filiformes, ad 5 mm. longi. *Calycis* lobi 5, lanceolati, pubescentes, nervis 5–7, marginibus scariosis. *Petala* 5, connata, flava, 5–7 mm. longa. *Filamenta* villosa. *Capsula* ellipsoidea, villosa, 4 mm. longa. *Semina* minuta, rubra, tuberculis spiraliter conjunctis ornata.

S. INDIA Tinnevelly District, in sholas, in cool and shady places, near Kodamadi above Mundanthorai, *K. Rangachari*, March 15, 1917, *C. C. Jacob*, Feb. 6, 1921, Madras Herb. no. 14618.

1022. **Rhamnus pentapomica,** *Parker* [Rhamnaceae–Rhamneae]; a *R. persica*, Boiss., foliis saepe majoribus, rima seminis apice marginibus non introflexis differt.

Frutex vel arbor parva. Foliis deciduis, ramulis breviter velutinis, nonnunquam apice spinescentibus. *Folia* 1·5–5 cm. longa., 0·6–2 cm. lata, oblonga, elliptico-lanceolata vel elliptico-oblanceolata, apice et basi attenuata, supra glabra, subtus minute velutina, remote crenulata vel integra; petiolus 2–10 mm. longus, breviter velutinus. *Flores* breviter pedicellati, fasciculati. *Calycis* laciniae triangulares. *Petala* minuta, oblanceolata. *Discus* velutinus. *Stylus* 2–4-partitus. *Drupa* 5 mm. longa, nigra, obovoideo-globosa. *Semina* nitida, eleganter verrucosa, rima hiante margine cartilaginea—*R. persica*, Lawson in Hook. f. Fl. Brit. Ind. i, 638, ex parte, non Boiss.

N.W. INDIA. Baluchistan, Salt Range, and outer Himalaya 600–1500 m. as far east as Garhwal. Baluchistan, *Lace* 3690; N.W. India, *Aitchison* 310; 1036; *Stewart* 42; *Edgeworth* 360; *Jerram*, Rawalpindi, Jhelum, *Jowala Pershad*, 48.

1023. **Rhamnus prostrata,** *Jacquem.* Journ. ii. 346, (1841) in obs., nomen; ex *R. N. Parker* [Rhamnaceae–Rhamneae]; a *R. persica*, Boiss. habitu et disco glabro differt.

Frutex nanus, intricatus, ramis tortuosis, ramulis junioribus breviter tomentellis apice spinescentibus. *Folia* decidua 0·7–1·5 cm. longa, elliptica, obtusa, utrinque minute tomentella vel fere glabra, obscure crenulata; petiolus 1–3 mm. longus. *Flores* breviter pedicellati, fasciculati. *Calyx* cupuliformis, laciniis ovato-triangularibus. *Petala* anguste linearia, minuta. *Discus* glaber. *Stylus* 3-fidus. *Drupa* 5 mm. longa, nigra, obovoideo-globosa. *Semina* nitida, eleganter verrucosa; rima anguste hians, margine cartilaginea, apice introflexa, bifida. *R. persica*, Lawson in Hook. f. Fl. Brit. Ind. i. 638 ex parte, non Boiss.

N. W. Himalaya. In the arid region at 2700–4200 m. Garhwal, *Strachey* and *Winterbottom* 7; Kunawar 24–8–47, Spiti 30–8–47, Padar 20–6–48, Ladakh 5–7–48, Zanskar 28–6–48, Nubra 10–8–48, *T. Thomson*; Safed Koh, Afghanistan, *Aitchison* 915.

I have not seen a specimen of Jacquemont's but there is no doubt as to the plant he refers to, as T. Thomson's specimen collected on 30–8–47 came from the same locality.

1024. **Potentilla sericophylla,** *Parker* [Rosaceae–Potentilleae]; affinis *P. lignosae*, Willd. et *P. Lindenbergii*, Lehm., ab prima habitu, sepalis exterioribus et interioribus subaequalibus et capellis, ab secunda foliolis omnibus subintegris utrinque sericeo-pilosis et floribus majoribus differt.

Frutex nanus; rami stipulis persistentibus obtecti. *Folia* petiolata, non articulata, (petiolo incluso) 2–5 cm. longa; stipulae petiolo adnatae, scariosae, amplexicaules. *Foliola* 7 vel 9, nonnunquam 5·5–15 mm. longa, oblanceolata, obscure denticulata, apice rotundata, utrinque (praecipue infra) sericeo-pilosa. *Flores* 1·5–1·8 cm. diametro, 1–4, pedunculati, ex apice ramulorum oreintes, folia superantes. *Sepala* externa linearilanceolata, interna ovato-lanceolata, acuta, extra sericeo-pilosa. *Petala* obovata, intergerima, calyce vix longiora, alba. *Antherae* oblongae, infra emarginatae, connectivo non dilatato. *Stylus* subbasalis, filiformis, carpello maturo duplo longior; stigma non dilatum. *Achenia* apice et dorso pilosa, basin versus glabra.

N.W. India. On rocks at 2400 m. Hazara, *Stewart* 352, *Barrett*, *Parker*; Chitral, *Barrett*.

1025. **Tricholepis Toppinii,** Dunn [Compositae-Cynaroideae]; affinis *T. tibeticae*, Hook. f., sed foliis numerosis oblongis papyraceis, capitulis nutantibus, bracteis involucrantibus longioribus, externis e basi subulatis differt.

Herba erecta, 30 cm. alta, basi sublignosa, capitulis exceptis glabra; *Caulis* ramosus, foliosus, striatus. *Folia* sessilia, lineari-oblonga, basi cuneata, 1–6 cm. longa, fere ad capitula gradatim decrescentia, cuspidato-dentata, inferiora obtusa, basi saepe paullo pinnatifida. *Capitula* ovoidea, in caule ramisque solitaria, mox nutantia, basi rotundata, 3 cm. longa, 2·5 cm.

diametro. *Bracteae* involucrales, pluriseriatae, interiores anguste lineares, pubescentes, exteriores capilliformes glabrae, squarrosae, in alabastro in penicillum purpureum confertae, extremae breviores. *Corolla* purpurea, tubiformis, 2 cm. longa, dimidio superiore ampliato; laciniae 5, lineares, obtusae, 4–5 mm. longae. *Antherae* basi sagittatae, caudicibus gracilibus laceratis; filamenta puberula. *Styli* rami longi. *Achaenia* laevia. *Pappi* setae internae ad mediam corollam attingentes, barbellatae, exteriores breviores.

India. Kashmir: Ziarat; near Chitral, at 2700 m., August 1909, *Toppin* 603.

1026. **Begonia (Gireoudia) trigonoptera,** *Sprague* [Begoniaceae]; affinis *B. heracleifoliae*, Cham. et Schlecht., a qua ovarii corpore oblongo ala triangulari recedit.

Caudex brevissimus, crassus. *Folia* ultra 12, ascendentia, longipetiolata, palmatifida; petioli 1·5–1·8 dm. longi, pluricostati, costis pilis hyalinis deflexis singulis vel geminis instructis, rubro-guttati, apice annulo denso pilorum, pilis deflexis subulatis hyalinis basi rubris; lamina ad vel ultra medium palmatim sexloba, basi cordata, sinu angusto acuto propter convexitatem loborum exteriorum mox ampliato, supra glabriuscula, nigrescenti-maculata, subtus rubro-maculata, margine et nervis subtus sparse longe pilosa; lobi lanceolati, grosse serrato-dentati, acuti, laterales subfalcati, extimi saepe extrorsum lobulati; stipulae deltoideae, hyalinae, apice setiferae, circiter 1·5 cm. longae, 5 mm. connatae. *Inflorescentia* tota circiter 4·5 dm. longa, pedunculo 3 dm. longo longipiloso rubro-maculato maculis sublinearibus; cymae quinquies vel sexies furcatae, floribus masculis terminalibus, foemineis axillaribus. *Bracteae* ovatae, interdum cuspidatae, subfoliaceae, ad 1·5 cm. longae, valde concavae, conchiformes. *Flores masculi*: pedicelli 1·3 cm. longi, dense breviter glanduloso-pilosi. *Sepala* 2, obovata, 1·2–1·4 cm. longa, 9 mm. lata, extra quadrante infima pilis paucis glandulari-capitatis. *Petala* 0. *Stamina* circiter 30; antherae oblanceolato-oblongae, 1·75–2·5 mm. longae, superne 0·6 mm. latae, triente summa late introrsum dehiscentes; filamenta libera, 0·5–1 mm. longa. *Flores foeminei*: pedicelli 0·7–1·2 cm. longi. *Sepala* 2, suborbicularia, 9 mm. diametro, rosea, extra inferne pilis nonnullis glandulari-capitatis. *Petala* 0. *Ovarium* oblongum, deorsum leviter angustatum, 1·3–1·5 cm. longum, 6 mm. latum, viride, sparse roseo-punctatum, punctis pilos minutos glandulari-capitatos gerentibus; alae valde inaequales; ala princeps triangularis, decurrens, obtusa, rosea, 7 mm. lata, margine superiore subhorizontali 8–9 mm. longo, margine inferiore ascendente 1·5 cm. longo; alae caeterae 1·5–2 mm. latae, deorsum angustatae. *Placentae* bilamellatae, lamellis utrinque ovuliferis; ovula numerosissima, multiseriata. *Styli* basi 1 mm. connati; rami 2·5 mm. longi; stigmata lunata.

Guatemala. Alta Verapaz: Coban. Described from a living plant presented to Kew by the Royal Botanic Gardens,

Glasnevin, where it had been raised from seed received from Mr. Harry Johnson.

Begonia trigonoptera is closely allied to *B. heracleifolia*, Cham. et Schlecht., from which the shape of the ovary-body and wings serve to distinguish it. *B. trigonoptera* has an oblong ovary with very unequal wings, the largest being conspicuously triangular, and the smaller ones very narrow. *B. heracleifolia* and its varieties have an elliptic ovary with a rounded principal wing, and comparatively broad subsidiary ones.

1027. **Symplocos Barberi,** *Gamble* [Symplocaceae]; *S. roseae*, Bedd., affinis, foliis basi rotundatis vel cordatis, margine subintegris, racemis axillaribus brevibus eximie bracteatis differt.

Arbor parva, ramulis teretibus glabris. *Folia* membranacea, oblongo-oblanceolata, apice obtusa, acuta vel aliquando acuminata, basi rotundata vel cordata, subsessilia, glabra, margine integra vel aliquando apicem versus parce mucronato-serrata, 10–13 cm. longa, 3–4 cm. lata, costa supra impressa, infra prope basim pilis paucis strigosis munita; nervi utrinque 10–12, curvati et prope marginem arcuatim juncti; petiolus circiter 4 mm. longus, strigoso-hispidus. *Racemi* axillares, pauciflori, vix 1 cm. longi, hispidi, bracteis multis ovatis ferrugineo-villosis suffulti. *Calycis* lobi ovati, ferrugineo-villosi, 2–3 mm. longi, intus glabri. *Corollae* lobi oblongi, pilis paucis prope basim muniti. *Stamina* circiter 40, contra corollae lobos in fasciculos 5 aggregata. *Stylus* simplex, apice indistincte trilobus. *Drupa* oblonga, apicem versus paullo attenuata, glabra, ad 1·5 cm. longa, calycis lobis persistentibus incurvis munita.

S. India. Hills of Tinnevelly, *R. H. Beddome*, 1866 and 1869; Kalivayalpil, Tinnevelly, June 1, 1901, *C. A. Barber* 3066.

1028. **Jasminum rex,** *Dunn* [Oleaceae-Jasmineae]; *J. nobili*, C. B. Clarke, affinis, sed foliis majoribus oblongis magis conspicue trinervibus distincta.

Frutex scandens, omnino glaber. *Rami* graciles, teretes. *Folia* opposita, unifoliolata, oblonga, apice abrupte obtuse acuminata, basi rotundata, 9–12 cm. longa, 4·5–5·5 cm. lata, integra, subcoriacea, trinervia, nervis 3 infra prominentibus, ceteris obscuris; petioli 8–9 mm. longi. *Flores* maximi, in cymas laxas paucifloras terminales dispositi; pedicelli 1·5–2 cm. longi; bracteae setaceae, 2 mm. longae, persistentes *Calyx* tubulosus; dentes 5, distantes, anguste lineares, 8–9 mm. longi, tubo 3-plo longiores. *Corolla* alba; tubus 3 cm. longus. 2 mm. latus; lobi 9, obovato-oblongi, apice rotundati, apiculati, 2·5–3·5 cm. longi, 0·8–1 cm. lati. *Antherae* 2, prope basin tubi subsessiles. *Ovarium* 2-loculare; ovula in quoque loculo 2; stylus elongatus, tubum aequans; stigma in fauce tubi, bifidum. *Bacca* (una solum visa) ovoidea, 1·4 cm. longa, 8 mm. lata; semen unicum, epicarpio tenui carnoso cinctum.

Siam.—Cultivated in Bangkok, but said to be a native of the Siamese part of the Malay Peninsula. A photograph of the whole plant was sent with dried specimens to Kew by Mr. T. S.

Sanitwongse, M.B.C.M. (Edinburgh). His report of its supposed origin is supported by its relationship to *J. nobile*, C. B. Clarke, which occurs in the neighbouring state of Tenasserim. The photograph shows a climber covered with a profusion of remarkably large white flowers, and proves Mr. Sanitwongse's Jasmine to be one of the finest species in the genus.

1029. **Celsia Layardii,** *Ball*, ex *Turrill* in Herb. Kew [Scrophulariaceae-Verbasceae]; species *C. intricatae*, Benth., affinis, sed indumento stellato-tomentoso et floribus majoribus facile distinguitur.

Herba perennis, 3·5 dm. alta, dense stellato-tomentosa. *Folia* basalia lanceolata, apice acuta, basi in petiolum usque ad 4 cm. longum angustata, 5·5 cm. longa, 2–2·5 cm. lata, grosse sinuato-dentata. *Inflorescentia* divaricata, pedicellis usque ad 1·3 cm. longis. *Calyx* 5-fidus, segmentis oblongo-lanceolatis apice subacutis 4 mm. longis 2 mm. latis extra dense stellato-tomentosis intra minute glandulosis. *Corolla* 2·2 cm. diametro, lobis suborbicularibus 6 mm. longis. *Stamina* 4, filamentis duobus 4 mm. longis usque ad apicem dense violaceo-lanatis, duobus 5 mm. longis in parte suprema glabris alioquin dense violaceo-lanatis, antheris reniformibus 1·5 mm. longis duobus pilis clavatis tectis duobus glabris. *Ovarium* dense tomentosum, 2 mm. altum, 2 mm. diametro; stylus 8 mm. longus, glaber, superne ampliatus; stigma clavatum.

Orient. Mountains of Kurdistan, *A. H. Layard* 327; Mesopotamia, hills in the neighbourhood of Ramadie and Hit, in flower, March and April 1918, *G. A. Watson*.

1030. **Aechmea chromatica,** *C. H. Wright* [Bromeliaceae-Bromelieae]; species *A. Mariae-Reginae*, H. Wendl., affinis, foliis oblanceolatis bracteisque inermibus differt.

Folia circiter 12, rosulatim disposita; vagina subrotundata, 18 cm. longa, 18 cm. lata; lamina oblanceolata, 52 cm. longa, acute mucronata, primum minute furfuracea, demum glabra, medio incurva, 6 cm. lata, infra medium plana, 7 cm. lata, dentibus inferioribus 2 mm. longis, superioribus gradatim decrescentibus instructa. *Pedunculus* 15 cm. longus; bracteae oblongo-deltoideae, inermes, coccineae, 12 cm. longae, basi 4 cm. latae; spica pedunculo aequilonga, conica; rhachis pedicellique fere nigra. *Calycis* tubus cylindricus, glaber, atrocyaneus, 7 mm. longus; lobi obliqui, contorti, mucrone valido instructi, 7 mm. longi, infra dilute violacei, supra pallide carminei. *Petala* alba, oblonga, apice rotundata, 1·4 cm. longa, 3 mm. lata, squamis fimbriatis 3 mm. longis instructa. *Stamina* petalis semilonga; antherae oblongae, albae. *Stylus* petalis fere aequilongus; stigma album, spiraliter contortum.

Tropical America.—Described from a plant which flowered at Kew in February, 1920, the history of which has been lost.

The specific name refers to the gradation of colour in the calyx, which is deep indigo at the base passing into a gradually decreasing shade of violet in the lower part of the lobes, which

are pink in their upper part. A coloured drawing has been made for the Kew collection. The leaves are widest above the middle where they are incurved.

XXVII.—MISCELLANEOUS NOTES.

Captain G. J. L. Burton has been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, Plant Breeder in the Department of Agriculture, Kenya Colony.

Mr. A. C. Miles.—We learn that Mr. A. C. Miles, formerly Curator of Botanic Stations (*K. B.*, 1909, p. 22), has been appointed Senior Superintendent in the Agricultural Department, The Gold Coast.

Rear-Admiral Sir Richard Massie Blomfield, K.C.M.G.—We record with regret the death of Sir Richard Massie Blomfield, in his 87th year, on June 26 at 32, Elm Park Gardens, S.W. He was an old and valued correspondent of Kew and his connection with Kew commenced in 1873 when he was a captain in the Royal Navy. In that year when he was in Japan he collected some 41 specimens and forwarded them to Kew.

He was keenly interested in Botany and Horticulture, and whilst Comptroller of the Port of Alexandria (from the institution of that office in 1879), took a great interest in the flora of Egypt. At that time he corresponded with Sir William Thiselton-Dyer, mainly about nomenclature of palms, etc., in Egypt.

He contributed the first paper in the Alexandria Horticultural Society's Bulletin no. 1, (1904) pp. 1–13, on "The Royal Horticultural Society."

Bulletin no. 4, (1909) pp. 1–16, contains an interesting article from his pen on the "Wild Flowers around Alexandria," and a portrait of the Admiral forms the frontispiece to this bulletin.

He wrote the introduction to W. Draper's Gardening in Egypt (1895), in which he gave a short history of gardening from the earliest times. His literary talents and keen interest in historical research is reflected in his contributions to Botany and Horticulture.

George Ralph Pierez.—We record with regret the death of Mr. G. R. Pierez, Assistant Superintendent of Agriculture, Nigeria. Mr. Pierez died of pneumonia at Bathurst, W. Africa, while on his way home to England on leave.

Mr. Pierez was appointed Assistant Superintendent in 1919 (*see K. B.*, 1019, p. 447), and had completed his first tour in the Colony. He had been in charge of the Calabar Botanic Gardens, where I spent a pleasant day in his company at the end of February. His death is a sad loss to the Department as he had just acquired the knowledge of Nigerian Agricultural affairs which he would have been able to develope fully for the advance of Agriculture in Nigeria. A. W. H.

Edgar W. Foster.—We record with regret the death of Mr. E. W. Foster, at the age of 42, at Netherne, Surrey, on June 23rd. Mr. Foster was appointed from Kew in 1901 as Curator of the Botanic Station, Lagos, and in 1906 was promoted to be Assistant Conservator of Forests, Nigeria (*K. B.*, 1906, p. 48), and afterwards he became Senior Conservator of Forests, Northern Provinces, Nigeria.

He was invalided home in June, 1919, and later was invalided on pension out of the Service.

George Badderly.—We record with deep regret the death of Mr. George Badderly who for 39 years was preparer in the Museums. Mr. Badderly retired in May 1919 (*K. B.*, 1919, p. 315). He died at the house of his son on July 6th in his 84th year, and was buried at Teddington Cemetery on July 9th 1921, the Director and other members of the Kew Staff being present at the funeral.

Professor Adolf Engler.—We are informed that Herr Professor Dr. A. Engler, Fr.M.L.S., LL.D. (Cantab.), etc. who for over thirty one years has been Director of the Botanic Gardens and Museums, Dahlem, Berlin, retired from that office on April 1st last. During his Directorship Professor Engler has been a constant and valued correspondent of Kew and by the loan of specimens, etc. has rendered ready and ungrudging assistance to this Institution in connection with the preparation of the Flora of Tropical Africa and other undertakings. Professor Engler has been succeeded in the Directorship by Dr. L. Diels, who has for many years filled the post of Assistant Director at Dahlem and is well known to British Botanists from his work on the flora of Western Australia.

Mr. Eugene Campbell.—We learn that Mr. E. J. F. Campbell who has been Curator of the Botanic Station, Belize, British Honduras, since 1896 (*K. B.*, 1896, p. 217), has retired on pension having reached the age limit after 24 years of valuable service in the Colony.

The Emir of Katsina.—The Emir paid a long visit to Kew on Monday, July 11th, and was conducted around the Gardens by the Assistant-Director. He was keenly interested in the collections, both in the open and in the plant houses and also in No. 1 Museum. In the Museum a small exhibition of Northern Nigerian products had been arranged and also specimens of plants likely to succeed in his province were carefully examined. Throughout his visit the Emir displayed a very intelligent appreciation of all he saw and evidently is possessed of considerable knowledge of the plants of Northern Nigeria and their economic possibilities.

He was accompanied by Mr. W. F. Gowers, C.M.G., Lieut.-Governor, Northern Provinces, and Mr. G. W. Webster, Resident Commissioner, Sokoto. His son, two members of his suite, and his scribe, who took full notes of all that was shown them, were also members of the party.

Gift of Drawings of South African Flowers.—An interesting addition has been made to the collections of the Royal Botanic Gardens, Kew, by the presentation by Major Sir Bartle C. Frere, Bt., D.S.O., of a series of drawings of flowers characteristic of the Western Province of the Cape of Good Hope, made by his sister, Miss Catherine Frances Frere, between the years 1877–1880, when her father, Sir Bartle Frere, G.C.B., G.C.S.I., was Governor. There are 34 pictures, many of them given up to single subjects, but on several sheets more than one species is represented. The subjects include amongst others, species of *Gladiolus Babiana*, *Ixia*, *Erica*, *Berkheya*, *Phylica*, and *Protea*. The pictures of the latter genus are particularly interesting for they remind us of a very striking group of plants, almost lost to present day cultivation, which, a centruy ago, was exceedingly popular in greenhouses in the British Isles. Species of *Protea* represented by the drawings are *P. mellifera*, *P. pulchella*, *P. leucosperma*, *P. penicillata*, and *P. speciosa*. The drawings are mounted in oak frames and have been arranged temporarily on the walls of a room on the first floor of Museum IV.

National Botanic Gardens, Union of South Africa.—The Director's report on the Botanic Garden at Kirstenbosch, near Cape Town, for the year 1920 has now been issued. A balance sheet that shows the salaries of the principal officials, *i.e.*, Curator, Ranger, Secretary, Lady Gardeners and Gardeners, to be no more than 845*l.* 19*s.* 0*d*, is apparently a record of services rendered at considerable personal sacrifice, and is an indication of a persevering struggle to make ends meet. Considering, too, the high rates of pay in South Africa, the wages bill for 1429*l.* 3*s.* 7*d.* seems totally inadequate for so large and important a botanic garden. We learn too from the report that *Buchu* has had to be grown in the gardens on a commercial scale in order to provide funds. With such inadequate financial support it is perhaps unnecessary to state that scientific investigations of the plants and plant products of the Union have been impossible during the year under review.

In 1919 Professor R. H. Compton, the Director, issued a memorandum appealing for more financial support, and the annual Government grant, which had been reduced during the war, has happily now been restored. But this amounts only to 1500*l.* and seems barely sufficient for the remuneration, at even a very low rate, of the Curator and the skilled assistance required in the gardens. Professor Compton states that at least a capital sum of 15,000*l.*, and an annual income of about

5000*l.*, is necessary to carry out the objects for which the gardens were established. We earnestly hope that Professor Compton's requirements will be fully met when the Government Commission on the lay-out, development and functions of the Gardens has considered the matter.

It is pleasing to note that the offer of the later Mr. J. D. Logan of a piece of land near Matjesfontein for the establishment of a garden of Karroo plants under Karroo conditions has been confirmed by his heirs. J. H.

The Marine Algae of the Danish West Indies.—The interest of the Danes in the study of natural history, not only in that of their own country, but of the distant parts of their kingdom, is strikingly shown in the remarkable series of memoirs on the Botany of the Faeroe Islands and the Botany of Iceland. The same spirit is apparent in the various publications by Dr. F. Børgensen on the marine algae of the Danish West Indies. His largest work on the algal flora of these Islands,* the final part of which has now been issued, is by far the most elaborate of any which has been published on the West Indian marine algae of any region and is based on extensive collections made by Dr. Børgensen during successive visits to the islands. This work, which contains the descriptions of many new species and innumerable critical notes, is marked throughout with extreme care and thoroughness. A special feature is the very large number of illustrations.

Although the islands in question have now passed to America (the Danish flag, after waving for over 250 years, being lowered in 1917), "The Marine Algae of the Danish West Indies" will for all time be found a standard treatise for students of the marine flora of the entire region. A. D. C.

Flora of the Upper Gangetic Plain. After the lapse of five years we are glad to welcome another part of Mr. Duthie's Flora. The families from *Coniferae* to *Juncaceae* are dealt with in 114 pages, full English descriptions being given of each plant treated of and artificial keys where necessary to the genera and species. Nearly half of this part is devoted to the *Orchidaceae*, of which 59 species occur in the area. Other important contributions are the account of the Agaves arranged according to the paper by Drummond and Prain (Agricultural Ledger, xiii. 78) and of the Dioscoreas based on Prain and Burkill's Synopsis (Journ. As. Soc. Beng. N.S. x. 5).

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* The Marine Algae of the Danish West Indies. By F. Børgensen. Bianco Luno, Copenhagen, 1913–1920.
Part I. Chlorophyceae, pp. 158, figs. 126, map 1. 1915.
Part II. Phaeophyceae, pp. 222, figs. 170. 1914.
Vol. II. Rhodophyceae, pp. 498, figs. 435. 1915–1920.

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Plate I.

FIG. 1.

FIG. 2.